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HOME DEPARTMENT

NOTIFICATION

The 8th May, 2025

No.19418—HOME-FSSIE-RULE-0001/2024/HD.— In exercise of the powers conferred under the proviso to Article 309 of the Constitution of India and in supersession of The Orissa Forensic Science (Method of Recruitment and conditions of Service) Rules, 1996 or orders or instructions, except in respect of things done or omitted to be done before such supersession, the Governor of Odisha hereby makes the following rules regulating the Method of Recruitment and Conditions of Service of the persons appointed to the Group 'A' and Group 'B' services of Odisha State Forensic Science Service, namely :—

PART-I

GENERAL

1. Short Title and Commencement.- (1) These rules may be called the "Odisha Forensic Science Service (Method of Recruitment and Conditions of Service of Group 'A' and Group 'B' posts) Rules, 2025".

(2) They shall come into force on the date of their publication in the *Odisha Gazette*.

2. Definitions.-

(1) In these rules, unless the context otherwise requires,-

- (a) 'Appointing Authority' means Government of Odisha;
- (b) 'Commission' means the Odisha Public Service Commission (OPSC);
- (c) 'Committee' means the Departmental Promotion Committee constituted under Rule 15;
- (d) 'Director General and Inspector General of Police' or 'DG and IG of Police' means Director General and Inspector General of Police of Odisha;
- (e) 'Director' means the Director of the State Forensic Science Laboratory, Odisha;

- (f) 'Division' means different streams of specialities in Forensic Science Service and includes Physics, Ballistics, Chemistry, Toxicology, Biology, Serology, Forensic Psychology, DNA, Cyber Forensic and Document Divisions;
- (g) 'Ex-Serviceman' means a person as defined in the Odisha Ex-Serviceman (recruitment to the State Civil Services and Posts) Rules, 1985;
- (h) 'Forensic Science Laboratory' means the State Forensic Science Laboratory, Regional Forensic Science Laboratory, District Forensic Science Laboratory and any other Forensic Science Laboratories as established by the State Government;
- (i) 'Government' means the Government of Odisha;
- (j) 'Persons with Disabilities' means person who have been granted with disability certificate by competent authority as per the provisions of the Rights of Persons with Disabilities (RPwD) Act, 2016;
- (k) 'Scheduled Castes' and 'Scheduled Tribes' shall have reference to the Scheduled Castes and Scheduled Tribes Specified in the Constitution (Scheduled Castes) Order, 1950 and the Constitution (Scheduled Tribe) Order, 1950, as the case may be, made under Article 341 and 342 of the Constitution of India;
- (l) 'SEBC' means the Socially and Educationally Backward Classes of citizens other than the Scheduled Castes and Scheduled Tribes as may be specified by the Government from time to time;
- (m) 'Sports Person' means a person, who would be issued identity card as sportsman by the Director, Sports as per Resolution no. 24808/Gen., dated the 18th November, 1985 of General Administration Department, as amended from time to time;
- (n) 'Select List' means the list finally approved by the Government under rules 12 and 18;
- (o) 'Service' means Odisha Forensic Science Service (Group-A and Group-B);
- (p) 'Schedule/Appendix' means Schedule/Appendix appended to these Rules; and
- (q) 'Year' means the calendar year;

(2) All other words and expressions used in these rules but not defined, unless the context otherwise requires, shall have the same meaning as assigned to them in the Odisha Service Code.

3. Divisions of Laboratory.- (1) The Forensic Science Laboratories may have one or more of the following Divisions. Further, Government by Notification or Orders may create any new Division as and when required to cope with the latest development in the Forensic Science.

- (i) Physics;
- (ii) Chemistry;
- (iii) Biology;
- (iv) Serology;
- (v) Ballistics;
- (vi) Toxicology;
- (vii) Forensic Psychology;
- (viii) DNA;
- (ix) Cyber Forensic; and
- (x) Document.

Explanation:- The erstwhile Lie-Detection Division is re-named as Forensic Psychology Division.

(2) All the recruitment or Promotions up to the post of Assistant Director shall be made division wise.

4. Constitution of Service.- The service shall consist of the following posts under Group-A and Group-B, namely;—

- (a) Director (Group 'A');
- (b) Joint Director(Group 'A');
- (c) Deputy Director (Group 'A');
- (d) Assistant Director(Group 'A');
- (e) Senior Scientific Officer(Group 'B'); and
- (f) Scientific Officer(Group 'B').

Note - Upon coming into force of this rules, the existing Assistant Scientific Officers appointed under the previous rules and amended thereof, shall be absorbed in the post of Scientific Officer and the post of Assistant Scientific Officer (ASO) shall be abolished.

PART-II

METHOD OF RECRUITMENT

5. Method of recruitment.- Subject to the provisions made in these rules, recruitment to different posts in the service shall be made by the following methods, namely:-

(1) In respect of Scientific Officer.- By means of direct recruitment through competitive examination to be conducted by the Commission.

(2) In respect of other posts.- By way of promotion as specified in rule 14

Provided that the number of posts to be filled up during a year would be decided by Government from time to time.

6. Reservations.- Notwithstanding anything contained in these rules, reservation of posts or vacancies, as the case may be, for , -

(1) the candidates belonging to Scheduled Castes and Scheduled Tribes shall be made in accordance with the provisions of the Odisha Reservation of Vacancies in Posts and Services (for Scheduled Castes and Scheduled Tribes) Act, 1975 and the rules made there under; or any other law or rule in force at the relevant time; and

(2) the candidates belonging to SEBC, Women, Sportsmen, Persons With Disabilities and Ex-Servicemen shall be made in accordance with the provisions made under such rules, orders or instructions issued in this behalf by the Government from time to time.

PART-III

DIRECT RECRUITMENT

7. Competitive Examination.- (1) The direct recruitment to the entry-level post of Scientific Officer through competitive examination shall be conducted by the Commission.

(2) Ordinarily, in the month of January of the year, the Government in consultation with the DG & IG of Police after determining the vacancy in the post of Scientific Officer, shall communicate the total number of vacancies, that is, the existing vacancies, if any, and the anticipated vacancies likely to arise during the recruitment year to be filled up through direct recruitment to the Commission, indicating the posts to be reserved for candidates belonging to different reserved categories;

(3) On receipt of the detailed category wise vacancies, the Commission shall notify the vacancies inviting application from the eligible candidates through open advertisement for filling up of vacant post by direct recruitment;

(4) The details of the advertisement shall be prepared by the Commission describing all the modalities and formalities of the direct recruitment process as decided by the Commission;

(5) candidature shall be cancelled, if in the opinion of the Commission, the candidate is not found eligible for consideration according to the eligibility criteria prescribed in the rules;

(6) The Competitive Examination shall consist of Written Examination (400 marks) and Personality Test or Viva Voce (50 Marks) as specified under Schedule-II.

8. Eligibility Criteria.— In order to be eligible for direct recruitment to the post of Scientific Officer (Group-B), a candidate must fulfil the following criteria in addition to the educational qualifications as provided under the rule 9 of these rules, namely:-

- (1) a candidate must be a citizen of India;
- (2) a candidate must be able to speak, read and write Odia and have ;
 - (i) passed Middle English School Examination with Odia as a language subject: or
 - (ii) passed H.S.C or equivalent examination with Odia as medium of examination in non-language subject, or
 - (iii) passed in Odia as language subject in the final examination of Class-VII from a School or educational institution recognized by the Government of Odisha or the Central Government; or
 - (iv) passed a test in Odia equivalent to Middle English School Standard conducted by the Board of Secondary Education, Odisha of the School and Mass Education Department.
- (3) a candidate must have basic knowledge in computer;
- (4) a candidate must not be ordinarily below the age of 21 years and above the age of thirty-two (32) years on the 1st day of January of the year of recruitment.

Provide that upper age limit in respect of reserved categories of candidates referred to in Rule -6 shall be relaxed in accordance with the provisions of the Acts, Rules, Orders or instructions, for the time-being in force, for the respective categories.

(5) a candidate must be of good mental condition and sound health and free from physical defect that is likely to interfere with the discharge of duties in the service and the candidate, who after such medical examination is not found to satisfy these requirements, shall not be appointed to the service;

- (6) a candidate must not have more than one spouse living:

provided that the Government may, if satisfied that such marriage is permissible under the personal law applicable to such person or there are other grounds for doing so, exempt any person from the operation of this rule; and

(7) a candidate must be of good moral and character. He/she should not have been convicted of any criminal offense.

9. Educational Qualification.- The candidates must have Post Graduate or Master's Degree from a recognised university or equivalent as mentioned in Schedule-I in respective divisions with minimum 55% of the aggregate marks in case of direct recruitment to the post of Scientific Officer. A candidate shall apply for one division only.

10. Personality Test or Viva Voce.- Personality Test or Viva Voce shall carry 50 (Fifty) marks. The Commission shall, shortlist the candidates for Personality Test or Viva Voce, twice the number of vacancy from each category in the order of merit as per their total cumulative marks secured in Paper-I and Paper-II in the Written Examination and if the number of candidates in any of such category is less than that, in that event all the candidates from that category shall be called for interview:

Provided that, only those candidates who secure the minimum qualifying marks in each Paper-I and Paper-II as fixed by the Commission at their discretion shall be shortlisted for Personality Test or Viva Voce.

11. Preparation of Merit List.- (1) The Commission shall prepare Division-wise merit list of candidates in order of merit based on the aggregate marks secured in the Competitive Examination (Written Examination + Personality Test or Viva Voce), subject to reservation against different social categories.

(2) In case of candidates securing same marks in Competitive Examination in aggregate (Written Examination + Personality Test or Viva Voce), the following principles shall be adopted:-

(a) Candidate securing higher marks in Paper-II of the Written Test shall be ranked higher.

(b) In case of further tie, the merit shall be arranged in order of date of birth (i.e. the older in age shall be ranked higher).

(3) The Commission shall recommend such list of candidates not exceeding the actual number of vacancies as published in the advertisement to the Government. The list shall also be published by the Commission for public information.

12. Select List.- (1) The Appointing Authority shall peruse the merit list of candidates recommended by the Commission under sub-rule (3) of rule 11. The Appointing Authority may compare them with the vacancies, which were notified by the Commission in the advertisement, and may seek any clarification from the Commission, if not satisfied with it.

(2) After receipt of clarifications, if any, the Appointing Authority shall approve the merit list recommended by the Commission, which shall form the Select List for the purpose of appointment.

(3) Appointment shall be made from the Select List in the order in which names appear in the Select List.

(4) The Select List will remain valid for a period of one year from the date of its approval by the Appointing Authority.

13. Appointment.-

No candidate shall be appointed from the select list made under rule (12), without-

- (a) verifying his or her character and antecedents.
- (b) submission of his or her Medical Fitness Certificate issued by the competent medical authority as the Government may prescribe.
- (c) verification of original certificates on eligibility for the post. This will include certificate of age, caste or category and educational qualifications, etc.

PART-VI

PROMOTION

14. Eligibility criteria for promotion- (a) No Scientific Officer shall be eligible for promotion to the post of Senior Scientific Officer in a Division unless, he/she has completed four (04) years of continuous service as such in the same Divisions under the State Forensic Science Services as on the 1st day of January of the year in which the Committee meets.

However, before being considered for promotion to the post of Senior Scientific Officer, he should have successfully completed the Basic Course of Training/ Diploma Training Course at National Forensic Science University, Gandhinagar, Gujrat / LokNayak Jayprakash Narayan National Institute Criminology and Forensic Science (LNJN NICFS), New Delhi or at any other designated Institute as decided by Director General and Inspector General of Police.

(b) No Senior Scientific Officer shall be eligible for promotion to the post of Assistant Director in a Division unless he/she has completed four (04) years of continuous service as such in the same Divisions under the State Forensic Science Services as on the 1st day of January of the year in which the Committee meets.

(c) No Assistant Director shall be eligible for promotion to the post of Deputy Director unless he/she has completed 12 years of continuous service in Odisha Forensic Science Service out of which 4 years of continuous service as such in any Division of the State Forensic Science Services as on the 1st day of January of the year in which the committee meets.

(d) No Deputy Director shall be eligible for promotion to the post of Joint Director unless he/she has completed 3 years of continuous service as such as on the 1st day of January of the year in which the Committee meets.

(e) Director shall be an officer from Indian Police Service not below the rank of Inspector General. However, in case suitable Indian Police Service officers are not available, then promotion to the post of Director may be made from the post of Joint Director who has completed minimum 03 years of continuous service in the post of Joint Director as on the 1st day of January of the year in which the Committee meets or as otherwise decided by the Government.

15. Constitution of Departmental Promotion Committee- (a) There shall be constituted a Committee for selection of officers for promotion to different posts in the service with the following members, namely:-

(i)	Secretary to Government, Home Department;	-	Chairman
(ii)	Director General & Inspector General of Police, Odisha; and	-	Member
(iii)	Director, State Forensic Science Laboratory, Odisha ; and	-	Member
(iv)	Deputy Secretary or Joint Secretary or Additional Secretary, Home Department, in charge of Establishment Section.	-	Member Convenor

(b) The Chairman may co-opt the services of the experts for evaluating the service record or research work of the candidates.

(c) The recommendation of the Committee shall be valid and can be acted upon notwithstanding the absence of any one or more of its members other than the Chairman:

Provided that the member or members so absents must have been duly invited to attend the meeting and the majority of the members constituting the Committee are present in the meeting.

16. Procedure for selection by the Committee - (a) The Board shall ordinarily meet at least once in each year preferably in the month of January to prepare a list of officers,

as are held by them, suitable for promotion to the next higher posts taking into account the existing and anticipated vacancies for the year.

(b) The Committee while considering the cases for promotion of suitable officers, shall follow the provisions of, –

- (i) the Odisha Civil Services, (Zone of Consideration for promotion) Rules, 1988,
- (ii) the Odisha Civil Services (Criteria for Promotion)Rules, 1992; and
- (iii) the Odisha Civil Services(Criteria for Selection for appointment including Promotion)Rules,2003; and
- (iv) any other laws, rules or instruction in the matter in force at the relevant time shall also be followed:

Provided that in case of promotion up to the post of Assistant Director (Group A) , the reservation of vacancies in posts and services (for Scheduled Castes and Scheduled Tribes) Act, 1975 and the rules made there under or any other law or rule in force at the relevant time shall also be followed.

17. Consultation with the Commission.- (a) The recommendations of the Committee under clause (c) of rule 15 shall be referred to the Commission along with service particulars included in the list for its concurrence including those whose cases have not been recommended, being found unsuitable.

(b) The Commission shall consider the list received along with the service particulars and furnish its recommendations to the Government.

18. Select List.- (a) The recommendations of the Commission in respect of reference made to it under sub-rule (1) of rule 12 shall be considered by Government and the list approved by Government shall form Select List for appointment to respective posts in the service.

(b) The list referred to under sub-rule(4) of rule 12 shall be ordinarily be in force for a period of one year from the date of its approval by the Government or until another selection list is prepared afresh, whichever is earlier.

PART-VII

OTHER CONDITIONS OF SERVICE

19. Deputation from other services.-Where the Government is of the opinion that it is necessary and expedient to do so, it may by notification fill up of the vacancies by deputation in the post of Assistant Director to Joint Director for a period not exceeding 5 years by suitable candidates from any other Central or State Government services or

autonomous educational and scientific bodies having equivalent qualifications or required experience in service.

20. Inter se-seniority and gradation list- (a) The 'Appointing Authority' shall maintain a separate Gradation List in each Division up to the post of Senior Scientific Officer.

(b) The Gradation list shall contain the name, qualification and date of joining in the post and their confirmation.

(c) A combined Gradation List of the Assistant Directors of all the Divisions shall be maintained separately for the purpose of determination of the zone of consideration for promotion to the post of Deputy Director in the manner as explained below;

Explanation I- *The date of notification on promotion to the post of Assistant Director in respective division based on the recommendation of the **Committee** shall constitute the criteria in preparing the combined Gradation List. The persons joining in the same calendar year shall be treated as the Assistant Director belonging to the same batch of year of allotment.*

Explanation II- *If two or more persons of different divisions have joined in the post of Assistant Director on the same date on the recommendation of the same **Committee**, their inter-se seniority shall be reckoned in a manner that the person, whose total length of service in the "**Service**" is higher shall be held senior in the Gradation list.*

Explanation III- *If two or more persons of different divisions have joined in the post of Assistant Director on the same date on the recommendation of the same **Committee** and they have same total length of service in the "**Service**" as explained under Explanation-II above, their inter-se seniority shall be reckoned in a manner that the person, who is senior in age shall be held senior in the Gradation list.*

21. Filling up of vacancies.- (a) Appointment to the service by direct recruitment shall be made in the order in which the names of the persons appear in the merit list furnished by the Commission.

(b) Appointment to different posts of the service by promotion shall be made in order in which the names of the persons appear in the select list as specified under sub-rule (3) of rule 12.

22. Probation and Confirmation.- (a) On appointment, an officer shall be placed on probation for a period of two years, if he or she is a direct recruit and one year, if he or she is a recruit by promotion, from the date of joining the post:

Provided that Government may, if it thinks fit, in any case or class of cases for good and sufficient reasons to be recorded in writing, extend the period of probation for another year but not exceeding two years:

Provided further that such period of probation shall not include;

- (i) Extraordinary leave;
- (ii) period of unauthorized absence; or
- (iii) any other period held to be not being on actual duty.

(b) The appointment of a probationer may for good and sufficient reasons to be recorded in writing, be terminated by the Government at any time without previous notice during the period of probation including extension of such period, if any, and in case of probationer appointed by way of promotion, after such termination, the officer shall deemed to have been reverted to his/her former post.

(c) A probationer after completing the period of probation to the satisfaction of Government shall be eligible for confirmation subject to the availability of substantive vacancy in the service.

23. Departmental Examination and Training.- (a) Every person appointed to the post of Scientific Officer by direct recruitment under sub-rule (3) of rule 12, during their probation period shall have to undergo the Basic Course of Training.

(b) The Basic Course of Training will be of three months duration, out of which two months training will be at State Forensic Science Laboratory, Bhubaneswar, Finger Print Bureau , Photo Bureau and in their respective disciplines , 15 days training in any District Forensic Science Laboratory and last 15 days training in any other Laboratories related to their disciplines, as approved by DG and IG of Police, Odisha.

(c) After completion of the Basic Course of Training, there will be an examination based on the training under sub-rule (a) consisting of 300 marks (Theory-200 and Practical-100). In order to pass the examination, the officer would need to secure 50% marks in both theory and practical separately:

Provided that the Government may, if so think fit, for reasons to be recorded in writing, exempt any persons or class of persons from passing the Departmental Examination.

24. Other conditions of service- The Conditions of service in regards to matter not covered by these rules shall be the same as are or as may from time to time be prescribed by the Government.

27. Issue of Executive Instructions.- The Government may issue executive instructions not inconsistent with the provisions of these rules as they consider necessary to regulate matters not specifically covered by these rules.

[See Rule-9]

Sl. No.	Name of the Divisions	Required qualifications
1	Physics	<p>(i) Master's Degree in Physics or Applied Physics or Electronics with Physics as one of the subjects during all three years at Bachelor of Science level from a recognized university,</p> <p style="text-align: center;">or</p> <p>(ii) Integrated M.Sc. in Physics from a recognized university,</p> <p style="text-align: center;">or</p> <p>(iii) Master's Degree in Forensic Science with Forensic Physics or Ballistics as one of the subjects and Physics or Forensic Science as one of the subjects during all three years at Bachelor of Science level from a recognized university,</p> <p style="text-align: center;">or</p> <p>(iv) Integrated M.Sc. in Forensic Science with Forensic Physics or Ballistics as one of the subjects from a recognized university.</p>

2	Ballistics	<p>(i) Master's Degree in Physics or Applied Physics or Mathematics or Applied Mathematics with Physics or Mathematics as one of the subjects during all three years at Bachelor of Science level from a recognized university,</p> <p style="text-align: center;">or</p> <p>(ii) Integrated M.Sc. in Physics or Mathematics from a recognized university,</p> <p style="text-align: center;">or</p> <p>(iii) Master's Degree in forensic Science with Forensic Physics or Ballistics as a subject and Physics or Mathematics or Forensic science as one of the subjects during all three years at Bachelor of Science level from a recognized university,</p> <p style="text-align: center;">or</p> <p>(iv) Integrated M.Sc. in Forensic Science with Forensic Physics or Ballistics as one of the subjects from a recognized university.</p>
3	Chemistry	<p>(i) Master's Degree in Chemistry or Analytical Chemistry or Applied Chemistry or Bio Chemistry or Pharmaceutical Chemistry or Pharmaceutical Quality Assurance,</p> <p style="text-align: center;">or</p> <p>(ii) Integrated M.Sc. in Chemistry from a recognized university,</p> <p style="text-align: center;">or</p> <p>(iii) Master's Degree in Forensic Science with Forensic Chemistry or Toxicology as one of the subjects and Chemistry as Honours subject at Bachelor of Science level or Bachelor of Science in Forensic Science from a recognized university,</p> <p style="text-align: center;">or</p> <p>(iv) Integrated M.Sc. in Forensic Science with Forensic Chemistry or Toxicology as one of the subjects from a recognized university.</p>

4	Toxicology	<p>(i) Master's Degree in Chemistry or Analytical Chemistry or Applied Chemistry from a recognized university,</p> <p style="text-align: center;">or</p> <p>(ii) Integrated M.Sc. in Chemistry from a recognized university,</p> <p style="text-align: center;">or</p> <p>(iii) Master's Degree in Forensic Science with Forensic Chemistry or Toxicology as one of the subjects and Chemistry as Honours subject at the Bachelor of Science level or Bachelor of Science in Forensic Science from a recognized university,</p> <p style="text-align: center;">or</p> <p>(iv) Integrated M.Sc. in Forensic Science with Forensic Chemistry or Toxicology as one of the subjects from a recognized university.</p>
5	Biology	<p>(i) Master's Degree in Zoology or Microbiology or Life Science or Genetics or Biotechnology or Biochemistry or Molecular Biology from a recognized university,</p> <p style="text-align: center;">or</p> <p>(ii) Integrated M.Sc. in Biology from a recognized university,</p> <p style="text-align: center;">or</p> <p>(iii) Master's Degree in Forensic Science with Forensic Biology or Serology or DNA as one of the subjects and Botany or Zoology as Honours subject at Bachelor of Science level or Bachelor of Science in Forensic Science from a recognized university,</p> <p style="text-align: center;">or</p> <p>(iv) Integrated M.Sc. in Forensic Science with Forensic Biology or Serology or DNA as one of the subjects from a recognized university.</p>

6	Serology	<p>(i) Master's Degree in Zoology or Microbiology or Life Science or Genetics or Biotechnology or Biochemistry or Molecular Biology from a recognized university,</p> <p>or</p> <p>(ii) Integrated M.Sc. in Biology from a recognized university,</p> <p>or</p> <p>(iii) Master's Degree in Forensic Science with Forensic Biology or Serology or DNA as one of the subjects and Botany or Zoology as Honours at Bachelor of Science level or Bachelor of Science in Forensic Science from a recognized university,</p> <p>or</p> <p>(iv) Integrated M.Sc. in Forensic Science with Forensic Biology or Serology or DNA as one of the subjects from a recognized university.</p>
7	Forensic Psychology	<p>Master's Degree in Psychology or Forensic Psychology with Psychology as Honours or principal subjects at Bachelor of Arts level or Bachelor of Science level from a recognised University.</p>
8	DNA	<p>(i) Master's Degree in Zoology or Bio-Technology or Genetics or Bio-Chemistry or Molecular Biology or Microbiology or Life Sciences from a recognized university,</p> <p>or</p> <p>(ii) Integrated M.Sc. in Biology from a recognized university,</p> <p>or</p> <p>(iii) Master's Degree in Forensic Science with Forensic Biology or Serology or DNA as one of the subjects and Zoology as Honours at Bachelor of Science level or Bachelor of Science in Forensic Science from a recognized university,</p> <p>or</p> <p>(iv) Integrated M.Sc. in Forensic Science with Forensic Biology or Serology or DNA as one of the subject from a recognized university.</p>
9	Cyber Forensic	<p>(i) Master's Degree (M.Sc. or M. Tech) in Computer Science or Computer Science and Engineering or Information Technology or Cyber Security from a recognised University,</p> <p>or</p>

		<p>(ii) Master's Degree in Computer Application with Bachelor's degree in Computer Application or Computer Science or Electronics or Physics or Mathematics ,or Information Technology from a recognised University,</p> <p style="text-align: center;">or</p> <p>(iv) Master's Degree in Digital Forensic or Forensic Science with specialization in Cyber Forensics or Information Security or Computer Science or Information Technology or Cyber Security or Multimedia Forensics or Information Communication Technology or Artificial Intelligence or Data Science or Cyber Security Management or Computer Science & Engineering.</p>
10	Document	Master's Degree in Physics or Chemistry or Forensic Science with Chemistry or Physics as one of the subjects at Bachelor of Science level from a recognised University.

Note: A candidate shall apply for one division only.

SCHEDULE-II

[See sub-rule (f) of Rule-7]

I. SCHEME OF COMPETITIVE EXAMINATION:

SI. No.	COMPONENT	MARKS
1	Written Examination (Paper-I and Paper-II)	Paper-I: 100
		Paper-II: 300
2	Personality Test or Viva Voce	50
TOTAL		450

II. Written Examination: Written Examination for the post of Scientific Officer shall consist of two papers as given below;

Paper	Subject	Maximum Marks	Time
Paper-I	<p>Part A- General English</p> <p>Questions in this paper shall cover Synonyms, Antonyms, use of common phrases & Idioms, use of appropriate Prepositions and Comprehension, ordering of words in a sentence, ordering of sentences, spotting of errors, use of appropriate and qualifying words etc. Number of questions shall be 50, each carrying equal mark (i.e. One mark).</p> <p>Part B- General Awareness, General Aptitude and Reasoning.</p> <p>The questions in this paper shall be to test the candidate's psychology and the general awareness. Questions on reasoning, aptitude, data interpretation and general awareness on Science, current affairs, Geography, History of India and Odisha, Indian constitution, Socio Economic Political Developments, Human rights, fundamentals of Computer, etc. Number of questions shall be 50, each carrying One mark (01).</p>	100	90 minutes (One and half hour)
Paper-II	<p>For each Division there shall be a separate paper. The standard, syllabus and subject for Paper-II against each Division is enclosed as Appendix-A.</p> <p>Number of questions shall be 150, each carrying two (02) marks.</p> <p>(Standard of questions in Paper II- Master's Degree)</p>	300	150 minutes (Two and half hour)

NOTE: (i) The written examination shall consist of Objective Type- Multiple Choice Questions only. The examination shall be conducted in a manner using Optical Mark Recognition (OMR) or Optical Character Recognition (OCR) sheet, or computer based test or any other objective modern method of assessment invoked at relevant point of time as decided by the Commission.

(ii) There shall be negative marking for each wrong answer/response by the candidates with a deduction of 25% of the marks allotted to each question in both Paper-I and Paper-II.

(iii) **Syllabus:** The syllabus of the Written Examination for paper-II has been appended at Appendix-A

Appendix-A

SYLLABI FOR WRITTEN EXAMINATION, PAPER-II

BIOLOGY DIVISION

UNIT-I : CELL STRUCTURE, MOLECULES AND THEIR INTERACTION: Structural organization and functions of cell including Plasma membrane, intracellular organelles (Nucleus, Mitochondria, Golgi-bodies, Lysosomes, Endoplasmic reticulum, Peroxisomes) and types and structure of Chromosomes, Cell division and cell cycle. Bio-molecules- Structure, composition and function(carbohydrates, lipids, proteins and nucleic acids), pH, buffer and buffer system, Enzymes- types and their functions, regulation, enzyme inhibition, iso-enzymes. Nucleic acids, their structure and functions, types of DNA and RNA, replication mechanism, Proteins synthesis.

UNIT-II : HUMAN ANATOMY AND PHYSIOLOGY: Tissues of body, epithelia and glands, their classification and functions, connective tissues, cartilage- structure and types, bones- formation , gross structure, fracture and healing, Structure and growth of teeth, types, dentition-pattern and formula, eruption sequence and age determination, dental anomalies and their significance in personal identification, bite marks of human/ animals and their analysis. Structure and functions of major organ systems and their physiology- Integumentary, digestive , skeleton, respiratory, cardiovascular, excretory, muscular and neuromuscular systems, blood physiology.

UNIT-III : ECOLOGY, ENVIRONMENT AND MICROBIOLOGY: Ecosystem and their types, ecological factors, types of pollution, types of waste, BOD, COD, effect on human health, algal blooms and identification and composition, eutrophication and their effects. Various types of planktons, diatoms, preparation and identification and their forensic importance. Diatom tests and its importance in drowning cases, precaution in collection, preservation and forwarding of biological samples for diatom test, methods of isolation of diatoms from different body tissues/ bone marrow and water samples. Soil and water analysis for various microbes, isolation, classification, cell structure of bacteria and fungi, spores, microbes of soil and spoiled food.

UNIT IV : BIOSYSTEMATICS, TAXONOMY, ANIMAL CLASSIFICATION AND

GENETICS: Chemotaxonomy, Cytotaxonomy, Molecular Taxonomy and General classification of Animals (classification of Invertebrates upto order, classification of chordates upto class) Mendelian and Non mendelian inheritance, linkage, recombination and crossing over, chromosomal basis of inheritance, sex linked inheritance, mutagenesis, genetic basis of sex determination, extra-nuclear inheritance, chromosomal aberration, Eugenics.

UNIT V : TOOLS AND TECHNIQUES IN BIOLOGY: Tissue preparation- fixation, preparation of paraffin and plastic blocks, sectioning- rotary microtome, cryostat, vibratome and ultrathin sectioning. Staining- various staining techniques- simple and double staining, histochemical staining for bio molecules, Decalcification of bones and tooth, immunocytochemicalstaining. Chromatographic techniques- Paper, TLC, GLC, HPLC, GCMS, Electrophoresis-gel, agar, SDS and rocket; Statistical analysis- data collection and processing, regression and correlation, ANOVA analysis, probability, t-test, p value, x2test (Chi square). 3

UNIT- VI : FORENSIC TECHNIQUES: ANTHROPOLOGY: Anatomical description of skeletons of human and animals as relevant to forensics, ossification and identification of bones for determination of age, sex, race, stature etc. forensic anthropometry/ osteometry and tools involved. Determination of personal identity- sex differences in skull, pelvis and other bones. Calculation of stature from long bones, identification of burnt bones. Recovery of and identification of skeletal remains in accident, crimes and mass disasters, recovery, packing and storage of fleshed and burnt bone remains of human/ animal of forensic importance . Skeletal pathology and trauma of bones, facial reconstruction and superimposition, craniofacial superimposition techniques as photographic and video superimposition.

UNIT-VII : PHYSICAL EVIDENCE COLLECTION & PACKAGING OF EXHIBITS FROM CRIME SCENE: Physical evidence, types and importance in a criminal investigation, Protecting a scene of crime – various steps involved, contamination issues. Reconstructing of crime scene, Protection of Packaging & transportation Biological Evidences their documentation and Chain of Custody Legal and court procedure pertaining to expert testimony, admissibility of scientific evidence under 293 CrPC.

MICROSCOPY AND ITS APPLICATION : Basic principles and working of simple,Compound , Comparison, Phase-contrast, stereo-zoom, Polarizing, Fluorescence, confocal microscopy, Scanning electron and transmission electron microscope, colorimeter analysis and UV light source.

Spectroscopy: Principle and significance of UV-Vis spectroscopy, Fluorescence spectroscopy, FRET, Luminescence, Circular Dichroism, Infra-Red spectroscopy, Raman spectroscopy, Nuclear Magnetic Resonance, X-ray diffraction, Mass spectrometry

UNIT-VIII : EXAMINATION OF BODY FLUIDS & THEIR STAINS: Introduction to various types of body fluids, Composition, Physical pattern and Identification of seminal stains: Occurrence and significance. Species Determination. Age of semen stain. Detailed Laboratory examination of semen stain. Polymorphic Enzymes in semen and their significance. D.N.A. typing of semen sample. Examination of Saliva, Urine, Perspiration and other physiological fluids presumptive tests (U.V. test, Florence test, Spermine (Barberio) test, Choline test, Acid phosphatase test) and confirmatory test including Azoospermic semen stain (p-30, *Prostate-specific antigen* or PSA, Microscopic examination), Morphological structure of spermatozoa of human and animals, Identification of lochial and menstrual blood stains by microscopic, biochemical and immuno-electrophoretic method, Identification and examination of other body fluids/stains—vaginal, saliva, urine, faeces, vomit etc., Secretor and non –secretor. Identification and examination of body tissues of human/animal.

IMMUNOLOGICAL TEST: Presumptive & Confirmatory Tests for blood and origin. Application of immunological techniques in forensic serology Determination of species by precipitin test (diffusion method) and Gelelectrophoresis. Innate and Adaptive immunity, B cell / T cell –structure, development, diversity and recognition. Antigen and Antibodies – structure, types and function of antibody, monoclonal antibodies, antigen, hapten, adjuvants, antigen-antibody interaction and their application. Blood groups- ABO, MN, Rh polymorphic blood groups, Application of ABO blood group in disputed paternity cases, polymorphic enzymes and polymorphic proteins in the reference of forensic serology. HLA antigen. Secretor and non secretor status. Blood grouping in biological fluids other than blood. Determination of ABO blood group by absorption inhibition, absorption elution and mixed agglutination method.

UNIT-IX : FORENSIC GENETICS AND ROLE OF DNA FINGERPRINTING: History of DNA fingerprinting, utility of DNA fingerprinting in crime investigation in parentage dispute, wild life, veterinary and agriculture etc., Legal and Ethical issues. Collection, preservation and transport of samples viz, semen, saliva, hair, bone, flesh etc for DNA profiling, DNA methodology for isolation, typing, interpretation of results, STR analysis, polymerase chain reaction, types and its application, mitochondrial analysis, determination of sex & species and racial origin. **Analytical** techniques: Chromatography, Gel filtration, Ion exchange and affinity chromatography, Electrophoresis, SDS-PAGE, AGE, PFGE,

Southern, Northern and Western blotting, ELISA, DNA foot printing, PCR, Asymmetric PCR, methylation-specific PCR, Nested PCR, Inverse PCR, reverse transcriptase PCR, Real-time-PCR, Protein sequencing methods, DNA sequencing methods, Next Generation Sequencing RFLP maps, RAPD markers, AFLP markers, SNP analysis.

UNIT-X : WILD LIFE FORENSICS: Wildlife, Importance of protected and endangered species of Animals. National and International scenario of wildlife, Sanctuaries and National parks. Relevant provision of Wildlife and Environmental Act. Types of wildlife crimes, different methods of poaching of wildlife animals, Illegal Trade of wildlife material, Identification and examination of different kinds of wildlife crime exhibits. Examination of fabricated hides, ivory, nail etc. Identification of wildlife and domestic animal.

FORENSIC ENTOMOLOGY: Introduction, History, Significance, Classification and Biology of insects and other arthropods, Life cycle and forensic application of insects, Importance of some bacteria, Micro Organism and Insects in Forensic Science. Determination of time since death (postmortem interval i.e. PMI) - Dipterans larval development & succession on carrion and its relationship to determine time of death, impact of ecological factors on insects developments, rearing insects & calculating PMI, identification of larval instars, determining whether the body has been moved, linking suspect to the scene, Forensic Entomo-toxicology- identification of drugs and toxins from the insects and larvae feeding on the body, collection and preservation of entomological evidence at a crime scene.

HISTOLOGICAL AND ANATOMICAL EXAMINATION OF SOME PLANTS YIELDING DRUG: Morphology and anatomy of plants, types of plants yielding drugs of abuse— opium, cannabis, coca, tobacco. Identification of plants of Cannabis sativa (Ganja & bhang), opium (Papaver somniferum), tobacco (Nicotiana tabacum) etc. in criminal cases.

UNIT- XI :

Foundation of Biochemistry: Cellular and chemical foundations of life, Water: unique properties, weak interactions in aqueous systems, ionization of water, buffering action in biological system.

Carbohydrate chemistry: Structure of classification of monosaccharides, disaccharides, and polysaccharides, Glycolytic pathway, TCA cycle, pentose phosphate pathways, glycogen metabolism.

Lipid Chemistry: Building blocks of lipids - fatty acids, glycerol, ceramide; Structural lipids in membranes – glycerophospholipids; sphingolipids and sterols, Composition and

synthesis of lipoproteins and transportation, oxidation of fatty acids, biosynthesis of lipids, cholesterol metabolism.

Protein Chemistry: Structure and classification of amino acids, peptide, polypeptide, Ramachandran plot, protein folding, Primary, Secondary, Tertiary and Quaternary structure of proteins; essential, non-essential and non-standard amino acids.

UNIT-XII :

Molecular Genetics: Structure of chromatin and chromosomes, Central dogma of molecular biology, replication, transcription, translation, regulation of gene expression: transcriptional, translational and post-translational.

UNIT-XIII :

Basic concept of development: Basic features of development in animals, gametogenesis, types of eggs, fertilization, cleavage, and blastula, modification of development in evolution, generation of multicellular embryo, formation of germ layers, patterning of vertebrate body plan.

Reproductive Biology: Reproductive strategies and reproductive cycles in vertebrates, spermatogenesis, oogenesis, hormonal regulation in gametogenesis in male and female, In-vitro fertilization, embryo transfer technology. Nervous System: Organization of nervous system, somatic nervous system; sympathetic and parasympathetic system; structure and function of neuron and glial cells.

Musculo-skeletal System: Bone structure and function; smooth, cardiac and skeleton muscles, muscle contraction.

Endocrinology: Endocrine glands including pituitary, thyroid, etc; hormones, regulation of hormone secretion, peptide hormones and steroid hormones, biochemistry of hormone action.

Immunity: innate and acquired immunity, antibody, major histocompatibility complex, complement systems, T and B-cell maturation and differentiation, antigen processing and presentation, hypersensitive reaction and autoimmune diseases, polyclonal and monoclonal antibodies.

CHEMISTRY DIVISION

Unit I :

Analytical Chemistry : Classification of analytical methods – Classical and Instrumental, volumetric, titrimetric and gravimetric techniques, selection of proper analytical techniques: types and range of determination, accuracy, precision and errors, sample preparation, handling of reagents with safety, density and viscosity measurements.

Statistical Analysis : Mean, Mode, Median, Correlation and Regression analysis, Null Hypothesis, Variance, t-test, Chi-Square test. Type of Data, Measure of central tendency, Dispersion of Data, Correlation, Probability and Proof.

Group Theory: Symmetry elements and operations; Point groups and character tables; Internal coordinates and vibrational modes; symmetry adapted linear combination of atomic orbitals (LCAO-MO); construction of hybrid orbitals using symmetry aspects.

Electrochemistry: Electrochemical cells and cell reactions; Standard electrode potentials; Nernst equation and its relation to ΔG ; Electrochemical series, emf of galvanic cells; Faraday's laws of electrolysis; Electrolytic conductance, specific, equivalent and molar conductivity, Kohlrausch's law; Concentration cells.

Unit II :

Analysis of unknown samples :-

Organic: Physical examination, element detection (N, S, Cl, Br, I, F), Functional Group analysis (-OH, -COOH, -NO₂, -NH₂, -CONH₂, -CO-, -CHO, Hydrocarbons).

Reaction Mechanisms: Basic mechanistic concepts – kinetic versus thermodynamic control, Hammond's postulate and Curtin-Hammett principle. Methods of determining reaction mechanisms through kinetics, identification of products, intermediates and isotopic labelling. Linear free-energy relationship – Hammett and Taft equations. Nucleophilic and electrophilic substitution reactions (both aromatic and aliphatic). Addition reactions to carbon-carbon and carbon-heteroatom (N and O) multiple bonds. Elimination reactions. Reactive intermediates – carbocations, carbanions, carbenes, nitrenes, arynes and free radicals. Molecular rearrangements.

Pericyclic Reactions and Photochemistry: Electrocyclic, cycloaddition and sigmatropic reactions. Orbital correlations - FMO and PMO treatments, Woodward-Hoffmann rule. Photochemistry of alkenes, arenes and carbonyl compounds. Photooxidation and photoreduction. Di- π -methane rearrangement, Barton-McCombie reaction, Norrish type-I and II cleavage reaction.

Inorganic: Qualitative analysis of cations and anions with special reference to cations i.e. As, Sb, Pb, Ba, Cu, Hg, Zn and Tl and anions i.e. NO_2^- , NO_3^- , S_2^{2-} , SO_4^{2-} , SO_3^{2-} , halides and cyanides.

Main Group Elements: Hydrides, halides, oxides, oxoacids, nitrides, sulfides – shapes and reactivity. Structure and bonding of boranes, carboranes, silicones, silicates, boron nitride, borazines and phosphazenes. Allotropes of carbon, phosphorous and sulphur. Industrial synthesis of compounds of main group elements. Chemistry of noble gases, pseudohalogens, and interhalogen compounds. Acid-base concepts and principles (Lewis, Bronsted, HSAB and acidbase catalysis).

Transition Elements: Coordination Chemistry – structure and isomerism, theories of bonding (VBT, CFT, and MOT). Energy level diagrams in various crystal fields, CFSE, applications of CFT, JahnTeller distortion. Electronic spectra of transition metal complexes: spectroscopic term symbols, selection rules, Orgel and Tanabe-Sugano diagrams, nephelauxetic effect and Racah parameter, charge-transfer spectra. Magnetic properties of transition metal complexes. Ray-Dutt and Bailar twists, Reaction mechanisms: kinetic and thermodynamic stability, substitution and redox reactions. Metal-metal multiple bond.

Analysis of poisonous gases: CO, H_2S , PH_3 , CH_4 and NH_3 .

Salt Analysis

Unit III :

Spectroscopic and other techniques :-

Unifying principles : Electromagnetic radiation, interaction of electromagnetic radiation with matter- absorption, emission, transmission, reflection, refraction, dispersion, polarization and scattering.

Basic principles, instrumentation and applications: UV- Visible, FTIR, NMR, XRD, AAS, Mass, Spectroscopy, Fluorescence and Phosphorescence spectrophotometry, ESR Spectroscopy. Fundamentals of Acids, Bases and Buffers, pH, pKa, and pKb values, principles, instrumentation and applications of pH metry, Potentiometry, Conductometry and Microscopic analysis in forensic Science.

Unit IV:

Chromatography and Electrophoresis

General Principles and types of chromatographic techniques: Paper chromatography, column chromatography, Thin layer chromatography, adsorption chromatography, partition chromatography, Gas chromatography, Gas-liquid chromatography, Ion exchange

chromatography, Exclusion (permeation) chromatography, affinity chromatography, HPLC, HPTLC, HPTLC MS, Capillary Chromatography and Electrophoresis.

Unit V :

Basic Organic Chemistry: Important preparations and properties of alkanes, alkenes, alkynes, aromatic hydrocarbons, alcohols, phenols, carboxylic acids, aldehydes, ketones, amines and nitro compounds.

Unit VI

Proteins: Classification, Structure and Properties, Molecular weight determination, Isoelectric point, coagulation and denaturation. Carbohydrates: Classification, Structure and Reactions. Fats and **Lipids:** Classification, Structure and Reactions. **Alkaloids:** Classification, Isolation and Identification.

Unit VII :

Environmental Pollution- Air, water and soil pollutants, their permissible limits. Standards of potable water, water analysis, sources of water pollution. Analysis of agricultural, Industrial, and domestic effluents. Determination of adulterants in various food commodities. Pesticide analysis in food products. Soaps and detergents: Types and analysis. Detection of substandard fertilizers by chemical and instrumental techniques. Methods for sample collection and preparation, Health Safety Security and Environment Policies.

Unit VIII :

Paints, pigments and dyes- Classification and identification of dyes, analysis of dyes used in Trap cases. Role of dyes in crime investigation.

Paints and pigments: Types and chemical composition, toxic effects on living organisms and identification techniques, authenticity of brands of paints.

Unit IX :

Analysis and estimation of illicit liquor including methyl alcohol, ethyl alcohol, denatured spirit, acetone, chloroform, ether, other solvents and adulterants. Laws pertaining to Excise Act.

Unit X :

Metals, alloys and their types. Identification composition and analysis of metals and alloys by chemical methods and instrumental techniques. Hallmarking of precious metals as per BIS. Trace metal analysis and its forensic importance.

Unit XI :

Extraction, isolation & identification of Alkaloids viz- Morphine, Codeine, Brucine, Strychnine, Nicotine, Atropine, Hyoscyamine, Cocaine, Heroin and Dhatura

alkaloids.Extraction, isolation & identification of sedative, depressants, stimulants, opiates and drugs of abuse.

Unit XII :

Medicinal Chemistry: General drugs, Designer Drugs, Drugs of abuse, mode of administration and pharmacological action of drugs of forensic importance. Drugs Act, Excise Act and NDPS Act.

Unit XIII: Narcotics drugs and psychotropic substances: Definition, types, appearance, production and chemical characteristics. Common terminology of various drugs. Drug action on central nervous system. Sampling and analytical techniques for qualitative & quantitative analysis.

Unit XIV: - Plants of Narcotic importance and their morphology: Papaversomniferum, Cannabis sativa, Coca plant and analysis of their active constituents. Psychotropic substances: Amphetamines, Benzodiazepines and their derivatives. Barbiturates, Lysergides, Mescalines and Psilocybin etc.

Unit XV :Petroleum Products: Definition, types, sampling methods, specifications and characteristics as per BIS. Analytical tools for qualitative and quantitative analysis of petroleum products. Principles of techniques and Instruments used in detection of adulterants in petroleum products.

Unit XVI :Hydrocarbons : Cracking and reforming of hydrocarbons, distillation range of fuel oils of petroleum origin; Gasoline, Kerosene, diesel etc. and their correlation with GLC. Analysis of Lubricating oil, Grease, paints, adhesives and synthetic fibers. Determination of relative density, flashpoint, viscosity index, cetane number, octane number and dyes.

Unit- XVII :Arson and Burning cases: Legal definition of Arson and its motives. Types and chemistry of fire, fire safety and fire fighting techniques. Prevention of fire, Role of forensic science in investigation of fire, cause of ignition and evidence collection. Arson residue examination: Arson debris, burnt articles, flammable liquids, their collection, preservation and analysis. Dowry death cases: Investigation and analysis.

Unit- XVIII :Explosive: General aspects of explosive, their composition, properties and classification-high and low, Primary and secondary, military and commercial etc. Explosion theory, Explosive and improvised explosive devices. Theory and types of Non-explosive explosions. Sampling and analysis of debris from explosion sites. Laws: IPC Sections related to Arson and Explosives; EC Act; Petroleum Act.

CYBER FORENSIC DIVISION

1. Computer Fundamental, Operating System and File System- Computer System- History and development, Computer Organization and Architecture: Cache

memory. Primary and Secondary Storage devices, Input- Output device. Operating System and File System- Operating system, layered architecture/logical structure of operating system, types of OS, virtual machine, OS services, Process management, Memory management, Virtual Memory. Overview of operating system in Linux & windows. File System concepts, naming, attributes, operations, types, structure, file organization & access (Sequential, Direct, Index Sequential) methods, memory mapped files, directory structures.

2. Computer Network and Internet concepts- Introduction of computer networks, Network architecture, Introduction to TCP/IP Model, compare TCP/IP to (OSI) reference model, Network protocol: FTP, Telnet, DNS, DHCP, SNMP, SMTP, POP3 etc. Basic Mobile communication network Model, Wi-Fi network, Bluetooth, Broadband and optical fibre. Concept of IP address and their version IPv4 and IPv6, Web Hosting Concepts and Domain name Registration Process.

3. Cyber Security- Information security concepts, Overview: Background and current scenario, types of attacks, goals for security, E-commerce security, steganography. Security threats and vulnerabilities, overview of security threats, weak/strong passwords, insecure network connections, malicious code, programming bugs, cybercrime and cyber terrorism, information warfare and surveillance, virus, Trojan, worms, botnet, ransomware, shells.

4. Analyst Application Security- Basic Security concepts: hardware and software vulnerabilities. Password Cracking and Prevention: Introduction, password cracking techniques, dictionary based attack, brute force attack, cracking common files password, cracking web based password, password reset flaws, password change flaws, cracking Wi-Fi password, counter measures for users, counter measures for system administrators. Authentication & Authorization vulnerabilities: Authentication concepts, scenarios, user enumeration, direct page requests, parameter modification, lack of SSL at login pages, bypassing weak CAPTCHA mechanisms, login without SSL, Authorization: RBAC, authorization bypassing, parameter tampering, forceful browsing, rendering based authorization, client side validation attacks, insecure direct object reference. Input vulnerabilities: SQL injection, common implementation mistakes – authentication bypassing using SQL injection, cross site scripting.

5. Database Management System, Security and Vulnerabilities- Contents of the Subject Introduction: Overview of DBMS, Advantages of DBMS, Basic DBMS terminology. Data modeling using the Entity Relationship Model: mapping constraints, Generalization, Aggregation, Specialization, Extended ER model, relationships of higher degree.

Relational model: Storage Organizations for Relations, Relational Algebra, Set Operations, Relational Calculus, Concepts of Alternate key, candidate key, primary key, Foreign key, Integrity Rules, Data Dictionary. Normalization: Functional dependencies, normal forms, first, second, third normal forms, BCNF, inclusion dependencies, loss less join decompositions. Database Vulnerabilities, Threats & Physical Security: external and internal database threats; flaws in perimeter security. Data security policy: database security risks; database security testing; database auditing models and tools; user management strategies; maintenance policy, assessment and (counter) measures.

6. Information System Security and Cryptography- Cryptographic System, Classification of Cryptographic System, Substitution-Permutation Network, Feistel structure, Block Ciphers: DES, Double DES, AES, Stream Ciphers: LFSR, RC. Public Key Cryptography, RSA, Discrete Logarithm Problems, Diffie-Hellman, DSA, PKI. Data Integrity, Hash Functions: MD5, SHA, Message Authentication Codes. Emerging Application: Email Security, SSL/TLS, Web Security, Access Controls, Malwares, Firewalls, and Intruders. Digital Signature, User authentication - Token based, Biometric, Remote user authentication, Intrusion detection systems, honey pots, Denial of Service.

7. Malware Analysis- Goals of Malware Analysis, AV Scanning, Hashing, Finding Strings, Packing and Obfuscation, PEfile format, Static, Linked Libraries and Functions, Static Analysis tools, Virtual Machines and their usage in malware analysis, Sandboxing, Basic dynamic analysis, Malware execution, Process Monitoring, Viewing processes, Registry snapshots, Creating fake networks. Live malware analysis, dead malware analysis, analyzing traces of malware, system calls, api calls, registries, network activities. Anti-dynamic analysis techniques, VM detection techniques, Evasion techniques, Malware Sandbox, Monitoring with Process Monitor, Packet Sniffing with Wireshark, Kernel vs. User-Mode Debugging, OllyDbg, Breakpoints, Tracing, Exception Handling, Patching. Android Malware Analysis: Android architecture, App development cycle, APKTool, APKInspector, Dex2Jar, JD-GUI, Static and Dynamic Analysis.

8. Machine Learning and Big Data Analysis- Machine Learning Introduction: Well posed learning problems, Designing a Learning system, Perspective and Issues in Machine Learning. Concept Learning: Concept learning task, Concept learning as search, Find-S algorithm, Version space, Candidate Elimination algorithm, Inductive Bias. Decision Tree Learning: Decision tree representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm, hypothesis space search. Big data storage and analysis, comparison with other systems, rational database management system, grid computing, volunteer computing, convergence of key trends, unstructured data, industry

examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies.

9. Ethical Hacking and Wireless Hacking- Securing permission: Securing file and folder permission, Using the encrypting file system, Securing registry permissions. Securing service: Managing service permission. Wireless Hacking: Wireless Foot printing, Wireless Scanning and Enumeration, Gaining Access, Tools that exploiting WEP Weakness, Denial of Services Attacks, Firewalls: Firewalls landscape, Firewall Identification-Scanning Through firewalls, packet Filtering, Application Proxy Vulnerabilities, Denial of Service Attacks, Motivation of DoS Attackers, Types of DoS attacks, Generic DoS Attacks. Remote Control Insecurities, Discovering Remote Control Software, Connection, Weakness.VNC, Microsoft Terminal Server and Citrix ICA, Advanced Techniques Session Hijacking, Web Hacking, Web server hacking, web application hacking, Hacking the internet Use, Malicious Mobile code, SSL fraud, Email Hacking, IRC hacking, Global counter measures to Internet User Hacking.

10. Foundation of Multimedia Forensic and Image Processing- Introduction of digital signals: audio, image and video; Digitization process: sampling and quantization; Image Enhancement Techniques: Spatial and frequency domain; Image Compression Techniques: Introduction, lossy and lossless compression, Run length coding, scalar and vector quantization, JPEG and JPEG 2000 compression techniques; Image description and representation techniques: Introduction, boundary descriptor: chain code and shape number, regional descriptor: color and texture descriptors; Introduction to pattern clustering and classification. Basics of Multimedia; Devices for capturing image and video: digital camera and its components, acquisition process of digital image and video; Standards for video transmission; NTSC and PAL. Image Enhancement in the Spatial Domain: Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing. Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods. Image Restoration Filtering, Inverse Filtering . Color Fundamentals: Color Models, Pseudo color Image Processing, Basics of Full-Color Image Processing, Color Transformations, Smoothing and Sharpening, Color Segmentation, Noise in Color Images, Color Image Compression.

11. Mobile Forensics and Mobile Technology- Generation of mobile phones, types of mobile phones, basics of mobile phones and their components, identification of mobile phones, operating systems. Mobile phone technology: e.g. Asynchronous Transfer Mode (ATM), Wireless Applications Protocols (WAP), Advanced Mobile Phone System (AMPS),

Time Division Multiple Access (TDMA), Code Division Multiple Access (CDMA), Cellular Networks: GSM, GPRS, EDGE, UMTS, LTE, VoLTE. Mobile phone data acquisition by manual, logical, file system extraction and physical, Advanced Acquisition techniques. Overview of mobile forensic software.

12. Computer Forensics and DVR Forensic- Basics of computer forensics, acquisition methods, image format (Raw, DD, SMART, AFF, E01 etc.), disk and file encryption techniques, file signature analysis, windows registry analysis, artifacts recognition from slack space and unallocated space, metadata analysis. Basics of DVR and NVR, Types of CCTV camera and their characteristics, Operating Systems, enhancement of video and Authentication of video. Overview of Computer and DVR forensics software and tools: write blockers, imaging, and cloning devices.

13. Network Forensics and Cloud Forensics- Introduction to cloud technology, secure cloud bases services, Cloud based Applications: Facebook, Instagram, Telegram, WhatsApp, Facebook Messenger. Monitoring computer networks and activities, live packet capturing, network intrusion detection, Types of Network Attack. Searching and collection of digital evidence from the network. Cell Site Analysis, CDR Analysis, Tower Dump, IP tracing, web domains analysis, IPDR Analysis, Mobile Phone tracing, Email Tracing.

14. Modern Digital devices and Digital Technologies- Modern digital Devices: Computer, Laptop, tablet, Mobile Phones, PoS, ATM machine, Smart watch, Drone, IoT devices. Crypto Currency, Blockchain Technologies, Cloud computing, Artificial Intelligence, Deep fake video technology, Dark Web, Anonymous browsing techniques.

15. Cyber Crimes & IT Act- Cyber space, cyber-crimes and types of cyber-crimes, Social media-use and misuse, hacking, unauthorized access, spoofing, phishing, cyber terrorism, cyber stalking, social engineering, DOS and DDOS attack, skimming, financial crimes, identity theft, Trojans, viruses, logic bombs, malware attack. The Information Technology Act, 2000 and its amendments. Related and relevant section of IPC, Indian Evidence Act, Indian Telegraph Act.

Search, seizure and Collection of digital evidence, Significance of hash value, chain of custody.

DNA DIVISION

I- BIOCHEMISTRY - Introduction to basic concepts, Ionic Equilibrium, Chemistry of bio-molecules, Nucleic acids, Protein structure, Enzymes, Enzyme kinetics. Carbohydrate metabolism, Lipid metabolism, Nitrogen metabolism, Nucleic acid metabolism, Prokaryotic Gene Expression, Regulation of prokaryotic genes expression and operon, Eukaryotic gene expression: DNA binding proteins, Transcription factors (TFs), Eukaryotic RNA

polymerase, Characterization of TATA box, Gene expression and Chromosome remodeling, Regulation of gene expression at transcriptional level.

Bioenergetics and Metabolism: Survey of metabolism: carbon, oxygen, nitrogen cycle catabolism, use of mutants and isotopes in the study of metabolism, compartmentation, food chain and energy flow. Cell bioenergetics: First and second law of thermodynamics, internal energy, enthalpy, entropy, concept of free energy, standard free energy, change of a chemical reaction, redox potentials ATP and high energy phosphate compounds. Electron transport chain and oxidative phosphorylation.

II- MOLECULAR BIOLOGY – Extracellular matrix and cell-cell interaction, Nucleus, Chromosomes, Cell cycle, Apoptosis, Cancer, Viruses, Bacteria, Bacterial plasmids, Cyanobacteria, Fungi, Microbial metabolism, Microbial pathogenesis. Medically important bacteria: Mode of infection and pathogenesis of Staphylococcus, Clostridium, Streptococcus, Enteropathogenic bacteria, Salmonella and Mycobacterium. Water and Osmoregulation, Cytoplasmic fluidity, Membrane-Structure and Function. Concept of membrane electrical potential, Cell Receptors, Signal Transduction, Intracellular Membrane and Protein Flow, Fluid Flow Circulation in Humans.

DNA: Chemical composition of DNA, C-value paradox, DNA replication Prokaryotic DNA replication, Eukaryotic-replication, DNA damage, RNAs: types, Genetic Engineering, restriction enzymes, DNA Modifying enzymes, Cloning vectors, Cloning hosts. Post transcriptional processing of RNA: Processing of rRNA, Processing of pre-tRNA, Pre-mRNA processing, Capping and polyadenylation, Splicing, Pre-mRNA Editing, Self splicing introns, Informosomes, mRNA stability and turn over, Genetic code, Prokaryotic Translation, Eukaryotic translation, Translational apparatus, Regulation of protein synthesis, Post translational processing, Processing of Pre-pro-proteins. Protein stability and turnover.

Cell signalling: Hormones and their receptors, cell surface receptor, signalling through G-protein coupled preceptors, signal transduction pathways, second messengers, regulation of signalling pathways.

Mammalian systems: Stem cells- Different kinds of stem cells and their characters, transformation into different types, cell types-molecular approach, Bone marrow, multipotent stem cells, Hematopoietic stem cells and their mode of differentiation and development into a variety of circulatory cells. Molecular approach Embryonic cells- pleuripotent cells, induction of differentiation and the factors and the mechanism. Stem cell engineering, applications and prospects.

Renewal of tissues and tissue engineering: Renewal of cells that are lost in adult tissues such as epidermal cells, mammary gland cells, photoreceptor cells in retina, liver cells. Differentiation and development of muscle cells-embryonic somites to myoblasts, myogenic genes and expression, muscle developmental factors such as MEFs and MRFs, terminal differentiation of myoblasts.

III- GENETICS - Mendelism, Extensions of Mendelian principles, Evolution of genes concept, Linkage and chromosomal mapping, Inbreeding depression and Heterosis, sex linkage and sex determination, chromosomal and gene mutations. Population genetics, Quantitative genetics, Evolutionary genetics. Cytogenetic aspects of cell division, Variation at the genetic level: DNA markers – VNTR, STR, microsatellite, SNP and their detection techniques – RFLP, genotyping, RAPD, AFLP etc.), Construction of DNA libraries, Genome sequencing Molecular Evolution, Techniques for studying bacteriophages and Transposable phage (phage Mu).

Chromosomal anomalies and Techniques in the study of chromosome and their applications: Short term (lymphocyte) and long term (fibroblast) cultures, chromosome preparations, karyotyping, banding, chromosome labeling. *In situ* hybridization, chromosome painting, comparative genome hybridization (CGH), somatic cell hybrids and gene mapping, premature chromosome condensation.

Variation at the genetic level: DNA markers – VNTR, STR, microsatellite, SNP and their detection techniques – RFLP, genotyping, RAPD, AFLP etc. Gene expression: Basic processes and Gene regulation and Introduction to Human Genetics: History of early perception, development and documentation; genome organization; Chromosome structure, function and implications for disease. Study tools in Human Genetics: Human genome mapping methods; Physical mapping: Introduction to physical map markers- Human genome analysis: Conception, mapping cloning and sequencing, Outcome- Generation of 'OMICS' era, significant leads.

IV- MICROBIOLOGY - Diversity Of Prokaryotic And Eukaryotic Microbes. Archaea, Bacteria, Fungal Systematics and Diversity, Mycorrhizal fungi, Agriculturally important toxigenic fungi, secondary metabolites from fungi, Genomics and Biodiversity of yeast, Antagonistic interactions in yeasts, Biotechnological application of yeasts.

Virology: Animal Viruses Classification, Morphology and Chemistry of Viruses, Working with viruses, Virus replication Strategies, Replication patterns of specific viruses. Pathogenesis of viral infection, Anti-viral strategies prevention and control of viral diseases. Plant and microbial viruses classification, Morphology and Chemistry of Viruses.

Microbial Pathogenicity: Classical view of microbial pathogenicity, Molecular microbial pathogenicity, Emerging and re-emerging pathogens, Molecular mycological epidemiology, Environmental change and infectious diseases, Anti microbial resistance, newer vaccines, Rapid diagnostic principles.

V- BIOTECHNOLOGY –

Organization of structure and functions of prokaryotic and eukaryotic cells

- a. Cell wall and cell membrane: physical structure of biological membranes in prokaryotes and eukaryotes, lipid bilayer, membrane proteins, other constituents, diffusion, osmosis, active transport regulation of intracellular transport and electrical properties.
- b. Structural organization and functions of cell organelles, Cytoskeletons structure and motility function.
- c. Organization of genomes: genes and chromosomes, operon unique and repetitive DNA interrupted genes, gene families structure of chromatin and chromosomes, heterochromatin, euchromatin, transposons.
- d. Cell division and cell cycle, Apoptosis, Necrosis and Autophagy.

Recombinant DNA Technology and Applications: Restriction and Modification systems in *E. coli* and their use in recombinant library constructions. Restriction and Modifications enzymes and their uses. Basic techniques for RDT including Agarose gel electrophoresis, PAGE, Pulse field electrophoresis. Basic Biology of plasmids including their replication, copy number, incompatibility of plasmids and development of Plasmid Vectors. Cloning and expressions vectors. Basic DNA sequencing methods, introduction to Next Generation Sequencing (NGS) Polymerase chain reaction and its application in research. Oligonucleotide synthesis, purification and its application in screening of libraries, cloning and mutagenesis, Synthetic gene assembly. Strategies for constructing cDNA libraries and screening using Nucleic acid and antibody probes. Subtractive Libraries, Expression based strategies for cloning of functional genes, differential mRNA display. Strategies for constructing Genomic libraries and screening using nucleic acid probes. Understanding of operon Lac, Trp, Arabinose, Tetracycline and their application in studying biological processes and development of vectors. Use of Tags to aid solubility and purification of DNA safety guidelines and regulatory aspects.

VI- IMMUNOLOGY AND PHYSIOLOGY - Cells and molecules involved in innate and adaptive immunity, antigens, antigenicity and immunogenicity B and T cell epitopes, structure and function of antibody molecules, generation of antibody diversity, monoclonal antibodies, antibody engineering, antigen-antibody interactions, MHC molecules, antigen

processing and presentation, activation and differentiation of B and T cells, B and T cell receptors, humoral and cell-mediated immune responses, primary and secondary immune modulation, the complement system, Toll-like receptors, Cell-mediated effector functions, inflammation, hypersensitivity and autoimmunity, immune response during bacterial (tuberculosis), parasitic (malaria) and viral (HIV) infections, congenital and acquired.

Physiology: Blood and cardiovascular System, Digestive System, Muscular system, Respiratory system, Nervous system, Sense organs, Excretory, Endocrinology and Reproductive system.

VII- TOOLS AND TECHNIQUES -

- a. Isolation and purification of DNA (gDNA and mtDNA), RNA and Protein.
- b. Biochemical Methods: Chromatography Ion exchange, Gel Filtration and Affinity chromatography. Electrophoresis: Native and SDS-PAGE, Iso electric focusing 2D-PAGE and its applications.
- c. UV/VIS spectrophotometer, Beer-Lambert's law and its use in determination of protein/nucleic acid concentration.
- d. Polymerase Chain Reaction and Real Time PCR Technique: Basic concept and application.
- e. Fluorescence, Spectroscopy: Basic concepts of excitation and emission Quenching, Theory and application of FRET.
- f. Sterilization Technique : Basic concept and application.
- g. Centrifugation: basic concepts of centrifugation. Calculation of g value from RPM. Density gradient centrifugation. Sedimentation velocity and Sedimentation equilibrium, Separation of sub-cellular components and macromolecules using high speed and ultracentrifugation.
- h. Microscopy: Bright field, phase contrast fluorescence, confocal and electron microscopy.
- a. Isotope Tracer Technique: Types of radiations measurement scintillation and gamma counters Background noise quenching, Applications interaction of radiation with matter, passage of neutrons through matter interaction of gamma rays with matter units of measuring radiation absorption. Radiolysis of water, free radicals in water Autoradiography.
- j. Biostatistics and Computer Applications: Measures of central tendency and dispersion: mean, median range, standard deviation and variance. Correlation and simple linear regression. Sampling: Sampling techniques, sampling errors, framing Hypothesis, level of significance, tests of significance (F & t test), chi-square test.

Computer Oriented statistical techniques. Frequency table of single discrete variable, computation of mean, variance and standard deviation, t-test correlation coefficient.

VIII- FORENSIC SCIENCE –

1. Definition and scope of forensic science- History and Development of forensic science, organization of the forensic science laboratory. Central and state forensic science laboratories, Directorate of forensic sciences. Functions of a forensic scientist.
2. Physical Evidence: Their significance, class and individual characteristics, identification and individualization of physical evidence, locards's exchange principle mobile forensic science laboratory and its deployment in scenes of crimes.
3. The scene of Crime: Crime scene search for physical evidence, photography, sketching, collection, preservation, packing and transportation of evidence, maintaining the chain of custody.
4. Microscopy: principles and different types of microscopes and its forensic applications.
5. Types and distribution of body fluids: Blood, blood stains, semen, seminal stains, urine (formation, composition, properties); amniotic fluid, sweat (formation, composition, properties); saliva, vaginal fluid, epithelial cells, etc., their analysis and forensic significance.
6. Wild life DNA analysis and its applications in forensic science.
7. Intellectual Property Rights (IPR) and its importance in DNA profiling with case studies.
8. Forensic DNA profiling –International, national and state level cases

FORENSIC PSYCHOLOGY

1. Biological basis of Behavior-

The Central and Peripheral Nervous Systems – Structure and functions.

Methods of Physiological Psychology: Invasive methods – Anatomical methods, degeneration techniques, lesion techniques, chemical methods, microelectrode studies. Non-invasive methods – EEG, Scanning methods.

Glandular system: Types and functions, Biological basis of Motivation: Hunger, Thirst, Sleep and Sex. Biological basis of Emotion: The Limbic system, Hormonal regulation of behavior. Genetics and behavior.

2. Perception and Learning-

Perception: Concept of Perceptual Organization & Illusions, Role of motivation and learning in perception, Learning Process, Fundamental theories: Thorndike, Guthrie, Hull, Classical Conditioning: Procedure, phenomena and related issues, Instrumental learning: Phenomena, Paradigms and theoretical issues; Reinforcement: Basic variables and schedules; Behavior modification and its applications, Cognitive approaches in learning: Latent learning, observational learning. Verbal learning.

3. Memory, Forgetting and Thinking-

Memory processes: Encoding, Storage, Retrieval, Stages of memory: Sensory memory, Short-term memory (Working memory), Long-term Memory (Declarative – Episodic and Semantic; Procedural), Theories of Forgetting: Interference, Retrieval Failure, Decay, Motivated forgetting.

Language and Thought Problem solving: Type, Strategies, and Obstacles, Decision-making: Types.

4. Intelligence and Personality-

Intelligence: Concept & Theories, Determinants of Personality: Biological and Socio-cultural, Approaches to the study of Personality: Psychoanalytical, Neo-Freudian, Social learning, Trait and Type, Cognitive, Humanistic, Existential, Transpersonal psychology. Other Theories: Rotter's Locus of Control, Seligman's Explanatory styles, Kohlberg's theory of Moral development.

5. Motivation and Emotion-

Basic motivational concepts: Instincts, Needs, Drives, Arousal, Incentives, Motivational Cycle. Approaches to the study of Motivation: Psychoanalytical, Ethological, S-R Cognitive, Humanistic Exploratory behavior and curiosity, Zuckerman's Sensation seeking achievement, affiliation and power, motivational competence, Self-regulation flow.

Emotions: Physiological correlates emotion regulation.

6. Social Psychology-

Social perception Attitude and its change within cultural context; Prosocial behavior Group and Social influence [Social Facilitation; Social loafing]; Social influence [Conformity, Peer Pressure, Persuasion, Compliance, Obedience, Social Power, Reactance], Group dynamics, Theories of intergroup relations [Minimal Group Experiment and Social Identity Theory, Relative Deprivation Theory, Realistic Conflict Theory, Balance Theories, Equity Theory, Social Exchange Theory], Applied Social Psychology: Environment and Law; Crowding.

7. Human Development: Stress and Coping-

Developmental processes: Nature, Principles, and Factors in development, Stages of Development. Successful aging. Various aspects of development: Sensory-motor, cognitive, language, emotional, social and moral. Conflicts: Sources and types, Stress and Coping: Concept, Models, Type A, B, C, D behaviors, Stress management strategies [Biofeedback, Music therapy, Breathing exercises, Progressive Muscular Relaxation, Guided Imagery, Mindfulness, Meditation, Yogasana, Stress Inoculation Training].

8. Psychopathology and Interventions-

Psychopathology: Concept, Classification and Causes, Psychotherapies: Psychoanalysis, Person-centered, Gestalt, Existential, Acceptance-Commitment Therapy, Behavior Therapy, REBT, CBT, MBCT, Play Therapy, Positive psychotherapy, Transactional Analysis, Dialectic behavior Therapy, Art Therapy, Performing Art Therapy, Family Therapy. Applications of Theories of Motivation and Learning, Counseling: Process, skills, and techniques.

9. Research Methodology-

Research: Meaning, Purpose, and Dimensions. Research Problems, Variables and Hypothesis, Sampling. Ethics in conducting and reporting research, Paradigms of research: Quantitative, Qualitative, Mixed methods approach, Methods of Research: Observation, Survey [Interview, Questionnaires], Experimental, Quasi-experimental, Field studies, Cross- Cultural Studies, Narratives, Case studies, Research Designs: Meaning and Types.

10. Psychological Testing-

Types and Characteristics of Psychological Tests. Ethical Issues in Psychological Testing, Areas of Testing: Intelligence, Neuropsychological tests, Personality assessment, Interest inventories and Attitude Applications of psychological testing in various settings: Clinical & Forensic settings.

11. Forensic Psychology-

Definition and scope of Forensic Psychology-Historical perspective; Developmental Theories, Role and responsibility of Forensic Psychologist, Legal Concepts and Evidence related Issues, Interrogative techniques, Forensic Psychology in India, Concept of Cyber Psychology: Cyber Pornography, Cyber bullying.

12. Forensic Psychological Assessment and Investigating Techniques-

Forensic Psychological Assessment and Crime Investigation Tools, Detection of deception, Methods for detection of deception. Interview and interrogation, Non-verbal detection, Forensic Statement Analysis, Hypnosis Layered Voice Analysis, Psychological

Autopsy, Narco-Analysis & Brain – Mapping, Eye Detect System, Current research in detection of deception/truth finding mechanisms, Eye witness testimony, Impact of Crime on Victim & Psychological Aid to Victim, Rehabilitation of Criminals.

13. Psychological Disorder and Criminal Behavior -

Concept and theories of Criminal Behavior, Punishment & type of Punishment, Psychology of Aggression & Violence, Emerging Crime trends in India, Prevention of Crime Juvenile delinquency and cause and prevention. Mentally ill offenders, Psycho-Path offenders, Serial killers, Criminal Profiling, Crime Scene Profiling, Sex- Offenders, Child Abuse & Domestic Violence, Psychological Profiling of Terrorist, Drug related Crime.

14. Psychology and Court –Room & Legal Aspect in Forensic Psychology-

Types of Court and role of psychologists – criminal, juvenile, civil & family court, Criminal Competency, Understanding court process and punishment. Effect of Attorney, Judges, Jurors & Defenders, Expert Testimony (Definition and Section under Indian Evidence Act), Requirements from the Investigating Officer, Consent (Article 21(3), Important Judgements (Selvi & Ors vs State of Karnataka, etc), Admissibility of Forensic Report in Court (Section 293 Cr. Mental Health and Law Supreme Court Judgment and NHRC Guideline).

15. Polygraph-

Meaning of Polygraph, Physiological Aspects (GSR/Blood Pressure/Respiration/Motor Activity), Psychological Aspects (Flight/Fight Response/Autonomic Nervous System), Sensors of Polygraph (Pneumograph/cardio – sphygmograph/galvanograph) Testing Procedure (Pre – test Interview/Examination, Proper/Post Test Interview) Types of Questionnaires (MGQT/POT/Card Test/Affirmative Test, etc), Polygraph and Autonomic Nervous System, Limitation in Polygraph, False Positive & False Negative Advantages and Limitations of Polygraph Examination.

PHYSICS DIVISION

Unit-I : Frame of reference, inertial and non inertial frames, Rotating frame of reference, Coriolis force conservation Laws. Collisions, impact parameter, centre of mass frame and analysis of collision in centre of mass frame and lab systems., rotational motion of rigid bodies, moment of inertia, products of inertia, conservation of angular momentum. Central forces, motion under inverse square law forces, Special Theory of Relativity, Michelson-Morely experiment, Lorentz Transformations-addition of velocities, Time dilation and length contraction, variation of mass with velocity, mass-energy equivalence.

Unit-II : Oscillations, simple harmonic motion, damped harmonic motion, forced oscillation and resonance. Wave equation, harmonic solutions, plane and spherical waves,

superposition of waves, beats, stationary waves Doppler's Effect, phase and group velocities. Conditions of interference, Newton's rings and Michelson's interferometer. Diffraction-Fresnel and Fraunhofer, diffraction by plain transmission grating, Rayleigh criterion, resolving power of grating and telescope.

Unit-III :Electric field and potential, Gauss's law. Poisson's and Laplace equations, dielectrics and polarization, Electromagnetic induction, transformer. Transient behaviour of R-C, and R-L, circuits, time constant. Response of an L-C-R circuit for alternating voltages; series and parallel resonance, band-width and Q-factor. Maxwell's equations and their application to plane electromagnetic wave. Poynting vector. Vector and scalar potentials; Wave equations in isotropic dielectrics, reflection and refraction at the boundary of two dielectrics; Fresnel's relations; Total internal reflection; Normal and anomalous dispersion; Lasers, He-Ne and Ruby lasers, spatial and temporal coherence.

Unit-IV :DeBorglie waves. Photo-electric effect, Compton effect, wave-particle duality, Uncertainty principle and its applications (like - size of H-atom, zero point energy, wave packet, finite width of energy levels). Schrodinger wave equation with applications for free particle potential step or particle in a one dimensional box, extension of results to three dimensional case, Hydrogen spectrum, electron spin, Stern-Gerlach experiment, space-quantisation, characteristic and continuous x-rays.

Unit-V :Band theory of solids - conductors, insulators and semiconductors; Bloch Theorem, effective mass, Electric conduction in metals, Sommerfeld theory of electrical conductivity, specific heat of solids - Einstein and Debye theories. Electronic specific heat, Widemann Franz law, Hall effect. Magnetic properties of materials: para, diaferro, anti-ferro and ferrimagnetism. Curie and Curie-Weiss Laws. Elements of superconductivity, Meissner effect, Josephson junctions and applications; Elementary ideas about high temperature superconductivity.

Unit-VI :Kirchhoff's law, Thevenin, Norton and maximum power-transfer theorems. p-n junction diode, ideal diode equation, use of diode for rectification, zener diode and its use in voltage regulation. Transistor, its biasing, common emitter amplifier. Digital electronics- Boolean identities, De Morgan's laws, logic gates and truth tables; Simple logic circuits.

UNIT -VII :Forensic Physics: Introduction and scope, tools and techniques, examination of vehicle in case of road traffic accident, skid marks evaluation. Physical Evidences: types and importance. Forensic Statistics: Types of data, measure of central tendency, dispersion of data, correlations and probability and proof. **Glass**: Types of glass and their composition-soda-lime, boro-silicate, safety glass, laminated, light-sensitive, tampered/ toughened, wire glass, coloured glass. Matching and comparison. Forensic examinations of

glass fractures-concentric and radial fractures. Colour, fluorescence, physical measurements, specific gravity examination and elemental analysis of glass evidence.**Paint:** Types of paint and their composition, macroscopic and microscopic analysis of paint pigments, pigment distribution, micro-chemical analysis- solubility test, pyrolysis gas chromatography, TLC, colorimetric analysis, IR spectroscopy and X-ray diffraction, elemental analysis, mass spectrometer, interpretation of paint evidence.

UNIT -VIII :Fibre: Types of fibres, forensic aspects of fibre examination- fluorescence, optical properties, refractive index, birefringence, dye analysis. Physical fit and chemical testing. TLC, IR-micro spectroscopy. Miscellaneous Evidences: wire, broken bangles, seals, counterfeit coins, ropes/ strings, synthetic fibers etc their introduction & forensic examination. Tool Marks: theory, types of tool marks, and their forensic examination, Restoration methods of obliterated marks.

UNIT-IX :Building Materials: Cement- composition, types, Forensic Analysis- bromoform test, fineness test, ignition-loss test, Identification of adulterated cement. Mortar and concrete analysis. Soil: Types and composition of soil, sample preparation, removal of contaminants, colour, turbidity test, pH measurements, microscopic examination, density gradient analysis, ignition-loss test, elemental analysis.

UNIT -X : Audio and Video Analysis and Tape Authentication: theory of voice production, theory of voice identification, acoustics of speech, the sound spectrograph, voice comparison -standards and methods of voice comparison, voice spectrograph and its significance. Speech recognition and speaker identification.

SEROLOGY DIVISION

UNIT-I : CELL STRUCTURE, MOLECULES AND THEIR INTERACTION: Structural organization and functions of cell including Plasma membrane, intracellular organelles (Nucleus, Mitochondria, Golgi-bodies, Lysosomes, Endoplasmic reticulum, Peroxisomes) and types and structure of Chromosomes, Cell division and cell cycle. Bio-molecules- Structure, composition and function (carbohydrates, lipids, proteins and nucleic acids), pH, buffer and buffer system, Enzymes- types and their functions, regulation, enzyme inhibition, iso-enzymes. Nucleic acids, their structure and functions, types of DNA and RNA, replication mechanism, Proteins synthesis.

UNIT-II: HUMAN ANATOMY AND PHYSIOLOGY: Tissues of body, epithelia and glands, their classification and functions, connective tissues, cartilage- structure and types, bones- formation, gross structure, fracture and healing, Structure and growth of teeth, types, dentition-pattern and formula, eruption sequence and age determination, dental anomalies and their significance in personal identification, bite marks of human/ animals

and their analysis. Structure and functions of major organ systems and their physiology- Integumentary, digestive, skeleton, respiratory, endocrine, nervous, cardiovascular, excretory, reproductive, muscular and neuromuscular systems, blood physiology.

UNIT-III: ECOLOGY, ENVIRONMENT AND MICROBIOLOGY: Ecosystem and their types, ecological factors, types of pollution, types of waste, BOD, COD, effect on human health, algal blooms and identification and composition, eutrophication and their effects. Various types of planktons, diatoms, preparation and identification and their forensic importance. Diatom tests and its importance in drowning cases, precaution in collection, preservation and forwarding of biological samples for diatom test, methods of isolation of diatoms from different body tissues/bone marrow and water samples. Soil and water analysis for various microbes, isolation, classification, cell structure of bacteria and fungi, spores, microbes of soil and spoiled food.

UNIT IV: BIOSYSTEMATICS, TAXONOMY, ANIMAL CLASSIFICATION AND GENETICS: Chemotaxonomy, Cytotaxonomy, Molecular Taxonomy and General classification of Animals (classification of Invertebrates upto order, classification of chordates upto class) Mendelian and Non mendelian inheritance, linkage, recombination and crossing over, chromosomal basis of inheritance, sex linked inheritance, chromosomal aberration, Eugenics.

UNIT V: TOOLS AND TECHNIQUES IN BIOLOGY: Tissue preparation- fixation, preparation of paraffin and plastic blocks, sectioning- rotary microtome, cryostat, vibratome and ultrathin sectioning. Staining- various staining techniques- simple and double staining, histochemical staining for bio molecules, Decalcification of bones and tooth, immunocytochemicalstaining. Chromatographic techniques- Paper, TLC, GLC, HPLC, GCMS, Electrophoresis-gel, agar, SDS and rocket; Statistical analysis- data collection and processing, regression and correlation, ANOVA analysis, probability, t-test, p value, x2test (Chi square). Centrifugation (Definition, principles and uses), Auto clave, Incubator, Hot air oven, UV chamber, Laminar Air Flow, Water Purification System and Forensic Mobile Multispectral Imaging System.

UNIT- VI: FORENSIC TECHNIQUES: ANTHROPOLOGY: Anatomical description of skeletons of human and animals as relevant to forensics, ossification and identification of bones for determination of age, sex, race, stature etc. forensic anthropometry/ osteometry and tools involved. Determination of personal identity- sex differences in skull, pelvis and other bones. Calculation of stature from long bones, identification of burnt bones. Recovery of and identification of skeletal remains in accident, crimes and mass disasters, recovery, packing and storage of fleshed and burnt bone remains of human/ animal of

forensic importance. Skeletal pathology and trauma of bones, facial reconstruction and superimposition, craniofacial superimposition techniques as photographic and video superimposition.

UNIT-VII :

PHYSICAL EVIDENCE COLLECTION & PACKAGING OF EXHIBITS FROM CRIME SCENE: Physical evidence, types and importance in a criminal investigation, Protecting a scene of crime – various steps involved, contamination issues. Reconstructing of crime scene, Protection of Packaging & transportation Biological Evidences their documentation and Chain of Custody Legal and court procedure pertaining to expert testimony, admissibility of scientific evidence under 293 CrPC.

MICROSCOPY AND ITS APPLICATION : Basic principles and working of simple, Compound, Comparison, Phase-contrast, stereo-zoom, Polarizing, Fluorescence, confocal microscopy, Scanning electron and transmission electron microscope, colorimeter analysis and UV light source. Spectroscopy: Principle and significance of UV-Vis spectroscopy, Fluorescence spectroscopy, FRET, Luminescence, Circular Dichroism, Infra-Red spectroscopy, Raman spectroscopy, Nuclear Magnetic Resonance, X-ray diffraction, Mass spectrometry.

UNIT-VIII :EXAMINATION OF BODY FLUIDS & THEIR STAINS: Introduction to various types of body fluids, Composition, Physical pattern and Identification of seminal stains: Occurrence and significance. Species Determination. Age of semen stain. Detailed Laboratory examination of semen stain. Polymorphic Enzymes in semen and their significance. D.N.A. typing of semen sample. Examination of Saliva, Urine, Perspiration and other physiological fluids presumptive tests (U.V. test, Florence test, Spermine (Barberio) test, Choline test, Acid phosphatase test) and confirmatory test including Azoospermic semen stain (p-30, *Prostate-specific antigen* or PSA, Microscopic examination), Morphological structure of spermatozoa of human and animals, Identification of lochial and menstrual blood stains by microscopic, biochemical and immuno-electrophoretic method, Identification and examination of other body fluids/stains–vaginal, saliva, urine, faeces, vomit etc., Secretor and non –secretor. Identification and examination of body tissues of human/animal.

IMMUNOLOGICAL TEST: Presumptive & Confirmatory Tests for blood and origin. Application of immunological techniques in forensic serology Determination of species by precipitin test Gel-diffusion method and Gel-electrophoresis. Innate and Adaptive immunity, B cell /T cell –structure, development, diversity and recognition. Antigen and Antibodies – structure, types and function of antibody, monoclonal antibodies, antigen,

haptens, adjuvants, antigen-antibody interaction and their application. Blood groups- ABO, MN, Rh polymorphic blood groups, Application of ABO blood group in disputed paternity cases, polymorphic enzymes and polymorphic proteins in the reference of forensic serology. HLA antigen. Secretor and non secretor status. Blood grouping in biological fluids other than blood. Determination of ABO blood group by absorption inhibition, absorption elution and mixed agglutination method.

UNIT-IX: FORENSIC GENETICS AND ROLE OF DNA FINGERPRINTING: History of DNA fingerprinting, utility of DNA fingerprinting in crime investigation in parentage dispute, wild life, veterinary and agriculture etc., Legal and Ethical issues. Collection, preservation and transport of samples viz, semen, saliva, hair, bone, flesh etc for DNA profiling, DNA methodology for isolation, typing, interpretation of results, STR analysis, polymerase chain reaction, types and its application, mitochondrial analysis, determination of sex & species and racial origin. **Analytical techniques:** Chromatography, Gel filtration, Ion exchange and affinity chromatography, Electrophoresis, SDS-PAGE, AGE, PFGE, Southern, Northern and Western blotting, ELISA, DNA foot printing, PCR, Asymmetric PCR, methylation-specific PCR, Nested PCR, Inverse PCR, reverse transcriptase PCR, Real-time-PCR, Protein sequencing methods, DNA sequencing methods, Next Generation Sequencing RFLP maps, RAPD markers, AFLP markers, SNP analysis.

UNIT-X: WILD LIFE FORENSICS: Wild life, Importance of protected and endangered species of Animals. National and International scenario of wild life, Sanctuaries and National parks. Relevant provision of wild life and environmental act. Types of wildlife crimes, different methods of poaching of wildlife animals, Illegal Trade of wildlife material, Identification and examination of different kinds of wildlife crime exhibits. Examination of fabricated hides, ivory, nail etc. Identification of Wild life and domestic animal.

FORENSIC ENTOMOLOGY: Introduction, History, Significance, Classification and Biology of insects and other arthropods, Life cycle and forensic application of insects, Importance of some bacteria, Micro Organism and Insects in Forensic Science. Determination of time since death (postmortem interval i.e. PMI) - Dipterans larval development & succession on carrion and its relationship to determine time of death, impact of ecological factors on insects developments, rearing insects & calculating PMI, identification of larval instars, determining whether the body has been moved, linking suspect to the scene, Forensic Entomo-toxicology- identification of drugs and toxins from the insects and larvae feeding on the body, collection and preservation of entomological evidence at a crime scene.

HISTOLOGICAL AND ANATOMICAL EXAMINATION OF SOME PLANTS YIELDING

DRUG: Morphology and anatomy of plants, types of plants yielding drugs of abuse – opium, cannabis, coca, tobacco. Identification of plants of Cannabis sativa (Ganja & bhang), opium (Papaversomniferum), tobacco (Nicotianatabacum) etc. in criminal cases.

UNIT-XI :Foundation of Biochemistry: Cellular and chemical foundations of life, Water: unique properties, weak interactions in aqueous systems, ionization of water, buffering action in biological system. **Carbohydrate chemistry:** Structure of classification of monosaccharides, disaccharides, and polysaccharides, Glycolytic pathway, TCA cycle, pentose phosphate pathways, glycogen metabolism. **Lipid Chemistry:** Building blocks of lipids - fatty acids, glycerol, ceramide; Structural lipids in membranes – glycerophospholipids; sphingolipids and sterols; Composition and synthesis of lipoproteins and transportation, oxidation of fatty acids, biosynthesis of lipids, cholesterol metabolism. **Protein Chemistry:** Structure and classification of amino acids, peptide, polypeptide, Ramachandran plot, protein folding, Primary, Secondary, Tertiary and Quaternary structure of proteins; essential, non-essential and non-standard amino acids. **Nucleic acid chemistry:** Structure of purine, pyrimidine, nucleoside & nucleotides, De-Novo synthesis of purine and pyrimidine, Synthesis of nucleoside di- and triphosphates, deoxynucleotides, degradation of purine and pyrimidine nucleotides, salvage pathways of nucleotides synthesis, different types of DNA and RNA, Watson-Crick model of DNA, Structure of mRNA, tRNA and rRNA.

UNIT-XII: Enzyme chemistry: Enzyme definition, basic principle of enzyme action, activation energy, General characteristics of enzymes; nature of enzymes - protein and non-protein (ribozymes – RNaseP, abzymes), apoenzyme, holoenzyme. Fischer's lock and key hypothesis, nomenclature and classification of enzymes, mechanisms of action various enzymes including chymotrypsin, lysozyme. **Enzyme kinetics:** Kinetics of single substrate reaction, Michaelis-Menten equation, Lineweaver-Burk plot, Eadie-Hofstee and Hanes plot. Determination of K_M and V_{max} , K_{cat} , specificity constant. Enzyme Inhibition: Reversible and irreversible inhibition, kinetics of bi-substrate reaction. **Enzyme regulation:** Allosteric enzymes, symmetrical and sequential model, Hill's coefficients, cooperativity, Enzyme regulation and feedback control, enzyme activity regulation by post translational modification.

UNIT-XIII: Classical genetics: Mendelian and non-Mendelian inheritance, genetic linkage, recombination and crossing over, chromosomal basis of inheritance, mutagenesis, genetic basis of sex determination, extra-nuclear inheritance. **Molecular Genetics:** Structure of chromatin and chromosomes, Central dogma of molecular biology, replication,

transcription, translation, regulation of gene expression: transcriptional, translational and post-translational. **Cell Biology:** Membrane models, chemical composition of membrane, membrane proteins, endocytosis, phagocytosis, liposomes and its application. Structure and functions of intracellular organelles such as nucleus, mitochondria, endoplasmic reticulum, golgi apparatus, lysosomes, plastids, peroxisomes.

UNIT-XIV Basic concept of development: Basic features of development in animals, gametogenesis, types of eggs, fertilization, cleavage, and blastula, modification of development in evolution, generation of multicellular embryo, formation of germ layers, patterning of vertebrate body plan. **Reproductive Biology:** Reproductive strategies and reproductive cycles in vertebrates, spermatogenesis, oogenesis, hormonal regulation in gametogenesis in male and female, In-vitro fertilization, embryo transfer technology. **Nervous System:** Organization of nervous system, somatic nervous system; sympathetic and parasympathetic system; structure and function of neuron and glial cells. **Musculo-skeletal System:** Bone structure and function; smooth, cardiac and skeleton muscles, muscle contraction. **Endocrinology:** Endocrine glands including pituitary, thyroid, etc; hormones, regulation of hormone secretion, peptide hormones and steroid hormones, biochemistry of hormone action. **Immunity:** innate and acquired immunity, antibody, major histocompatibility complex, complement systems, T and B-cell maturation and differentiation, antigen processing and presentation, hypersensitive reaction and autoimmune diseases, polyclonal and monoclonal antibodies.

UNIT-XV Blood: Components & functions of blood, lymph, CSF; Plasma and serum, major plasma proteins, Erythrocytes, Leukocytes, Platelets- structure and function; role of platelets in coagulation, Biochemical mechanism of blood clotting and fibrinolytic system. **Glycogen storage diseases:** Von Gierke, Pompe, Cori and McArdle. Anemia and amino acid metabolism: Hemophilia and thrombosis, Hemoglobin, sickle cell anemia, thalassemia, phenylketonuria, alkaptonuria, albinism, etc. **Electrolyte and acid balance:** Acid-base balance, regulation of electrolyte and water balance, renin-angiotensin system in human body. Clinical analysis: Functional test of liver, kidney, thyroid, pancreas, tissue biopsy, liquid biopsy, circulating nucleotides as molecular diagnosis.

UNIT-XVI: Immunological techniques: Immuno-electrophoresis, immune-precipitation, agglutination, RIA, ELISA, FACS, immune-fluorescence microscopy, Immuno-electron microscopy, Fluorescence In-situ hybridization (FISH), Chromatin immuno-precipitation. **Statistics:** 2test, χ^2 Data collection and processing, Regression and Correlation, ANOVA analysis Probabilities; t-test, p-value;

TOXICOLOGY DIVISION

Unit I :

Analytical Chemistry : Classification of analytical methods – Classical and Instrumental, volumetric, titrimetric and gravimetric techniques, selection of proper analytical techniques: types and range of determination, accuracy, precision and errors, sample preparation, handling of reagents with safety, density and viscosity measurements.

Statistical Analysis : Mean, Mode, Median, Correlation and Regression analysis, Null Hypothesis, Variance, t-test, Chi-Square test. Type of Data, Measure of central tendency, Dispersion of Data, Correlation, Probability and Proof.

Group Theory: Symmetry elements and operations; Point groups and character tables; Internal coordinates and vibrational modes; symmetry adapted linear combination of atomic orbitals (LCAO-MO); construction of hybrid orbitals using symmetry aspects.

Electrochemistry: Electrochemical cells and cell reactions; Standard electrode potentials; Nernst equation and its relation to ΔG ; Electrochemical series, emf of galvanic cells; Faraday's laws of electrolysis; Electrolytic conductance, specific, equivalent and molar conductivity, Kohlrausch's law; Concentration cells.

Unit II :

Analysis of unknown samples :-

Organic: Physical examination, element detection (N, S, Cl, Br, I, F), Functional Group analysis (-OH, -COOH, -NO₂, -NH₂, -CONH₂, -CO-, -CHO, Hydrocarbons).

Reaction Mechanisms: Basic mechanistic concepts – kinetic versus thermodynamic control, Hammond's postulate and Curtin-Hammett principle. Methods of determining reaction mechanisms through kinetics, identification of products, intermediates and isotopic labelling. Linear free-energy relationship – Hammett and Taft equations. Nucleophilic and electrophilic substitution reactions (both aromatic and aliphatic). Addition reactions to carbon-carbon and carbon-heteroatom (N and O) multiple bonds. Elimination reactions. Reactive intermediates – carbocations, carbanions, carbenes, nitrenes, arynes and free radicals. Molecular rearrangements.

Pericyclic Reactions and Photochemistry: Electrocyclic, cycloaddition and sigmatropic reactions. Orbital correlations - FMO and PMO treatments, Woodward-Hoffmann rule. Photochemistry of alkenes, arenes and carbonyl compounds. Photooxidation and photoreduction. Di- π -methane rearrangement, Barton-McCombie reaction, Norrish type-I and II cleavage reaction.

Inorganic: Qualitative analysis of cations and anions with special reference to cations i.e. As, Sb, Pb, Ba, Cu, Hg, Zn and Tl and anions i.e. NO_2^- , NO_3^- , S_2^{2-} , SO_4^{2-} , SO_3^{2-} , halides and cyanides.

Main Group Elements: Hydrides, halides, oxides, oxoacids, nitrides, sulfides – shapes and reactivity. Structure and bonding of boranes, carboranes, silicones, silicates, boron nitride, borazines and phosphazenes. Allotropes of carbon, phosphorous and sulphur. Industrial synthesis of compounds of main group elements. Chemistry of noble gases, pseudohalogens, and interhalogen compounds. Acid-base concepts and principles (Lewis, Bronsted, HSAB and acidbase catalysis).

Transition Elements: Coordination Chemistry – structure and isomerism, theories of bonding (VBT, CFT, and MOT). Energy level diagrams in various crystal fields, CFSE, applications of CFT, JahnTeller distortion. Electronic spectra of transition metal complexes: spectroscopic term symbols, selection rules, Orgel and Tanabe-Sugano diagrams, nephelauxetic effect and Racah parameter, charge-transfer spectra. Magnetic properties of transition metal complexes. Ray-Dutt and Bailar twists, Reaction mechanisms: kinetic and thermodynamic stability, substitution and redox reactions. Metal-metal multiple bond.

Analysis of poisonous gases: CO, H_2S , PH_3 , CH_4 and NH_3 .

Salt Analysis

Unit-III :

Spectroscopic and other techniques:-

Unifying principles : Electromagnetic radiation, interaction of electromagnetic radiation with matter- absorption, emission, transmission, reflection, refraction, dispersion, polarization and scattering. Basic principles, instrumentation and applications: UV- Visible, FTIR, AAS, Mass, Spectroscopy, Fluorescence and Phosphorescence spectrophotometry, ESR. Fundamentals of Acids, Bases and Buffers, pH, pKa, and pKb values, principles, instrumentation and applications of pH metry, Potentiometry, Conductometry and Microscopic analysis in forensic science.

Unit-IV :Chromatography and Electrophoresis: General Principles and types of chromatographic techniques: Paper chromatography, column chromatography, Thin layer chromatography, adsorption chromatography, partition chromatography, Gas chromatography, Gas-liquid chromatography, Ion exchange chromatography, Exclusion (permeation) chromatography, affinity chromatography, HPLC, HPTLC, HPTLC MS, Capillary Chromatography and Electrophoresis.

Unit-V :Basic Organic Chemistry: Important preparations and properties of alkanes, alkenes, alkynes, aromatic hydrocarbons, alcohols, phenols, carboxylic acids, aldehydes, ketones, amines and nitro compounds.

Unit-VI : Proteins: Classification, Structure and Properties, Molecular weight determination, Isoelectric point, coagulation and denaturation. Carbohydrates: Classification, Structure and Reactions. Fats and Lipids: Classification, Structure and Reactions. Alkaloids: Classification, Isolation and Identification.

Unit-VII :Forensic Toxicological examination and significance, Poison : Definition, classification, mode of action, chemical nature, methods of poison administration, Classification of poisoning : Accidental, homicidal and suicidal. Symptoms of poisoning and antidotes, Collection and preservation of toxicological exhibits in poisoning cases. Postmortem examination and postmortem changes, Medicolegal aspects of wounds, Modes of death.

Unit-VIII :Different methods of extraction and isolation of poisons from visceral organs and other biological specimens : Solvent extraction, distillation/steam distillation, micro diffusion, dialysis, dry ashing and wet digestion.

Pharmacology : Metabolism and excretion of poisons - Introduction, pathways of drug metabolism, nonsynthetic and synthetic pathways like oxidation, hydroxylation, N-and O-dealkylation, sulphoxide formation, conjugation, acetylation, methylation of drugs/poisons as exemplified by alcohols, aldehydes, ketones, aliphatic amines, phenols, cyanide, barbiturates, opiates, benzodiazepines and amphetamines.

Unit-IX :Analysis of volatile poisons, toxic metals and non-metallic anions in biological fluids. Analysis of pesticides :Organochlorinated, Organophosphorous, Synthetic pyrethroids, Carbamates, Aluminium phosphide and Zinc phosphide in visceral tissues.

Unit-X : Methods of analysis of acidic and neutral drugs in biological fluids, salicylic acid, benzoic acid, aspirin, meprobamate, barbiturates etc. Method of analysis of basic drugs of abuse from biological specimens : Opium and its alkaloids, atropine, strychnine, brucine, cocaine, amphetamines and its derivatives, benzodiazepines, LSD, ketamine, methaqualone and nicotine. Method of analysis of mechanical poisons- Glass, diamond and hair. Plant poisons and their examination :Datura, Atropa belladonna, Marking nut, Nux vomica, Oleander, Aconite, Abrus, Cannabis, Croton and poisonous fungi.

BALLISTIC DIVISION

Unit-I : Frame of reference, inertial and non inertial frames, Rotating frame of reference, Coriolis force, conservation Laws. Collisions, impact parameter, centre of mass frame and analysis of collision in centre of mass frame and lab systems, rotational motion

of rigid bodies, moment of inertia, products of inertia, conservation of angular momentum. Central forces, motion under inverse square law forces, Special Theory of Relativity, Michelson-Morely experiment, Lorentz Transformations-addition of velocities, Time dilation and length contraction, variation of mass with velocity, mass-energy equivalence.

Unit-II : Oscillations, simple harmonic motion, damped harmonic motion, forced oscillation and resonance. Wave equation, harmonic solutions, plane and spherical waves, superposition of waves, beats, stationary waves, Doppler's Effect, phase and group velocities. Conditions of interference, Newton's rings and Michelson's interferometer. Diffraction-Fresnel and Fraunhofer, diffraction by plain transmission grating, Rayleigh criterion, resolving power of grating and telescope.

Unit-III : Electric field and potential, Gauss's law. Poisson's and Laplace equations, dielectrics and polarization, Electromagnetic induction, transformer. Transient behaviour of R-C, and R-L, circuits, time constant. Response of an L-C-R circuit for alternating voltages; series and parallel resonance, band-width and Q-factor.

Maxwell's equations and their application to plane electromagnetic wave. Poynting vector. Vector and scalar potentials; Wave equations in isotropic dielectrics, reflection and refraction at the boundary of two dielectrics; Fresnel's relations; Total internal reflection; Normal and anomalous dispersion; Lasers, He-Ne and Ruby lasers, spatial and temporal coherence.

Unit-IV : De Broglie waves, Photo-electric effect, Compton effect, wave-particle duality, Uncertainty principle and its applications (like - size of H-atom, zero point energy, wave packet, finite width of energy levels). Schrodinger wave equation with applications for free particle potential step or particle in a one dimensional box, extension of results to three dimensional case, Hydrogen spectrum, electron spin, Stern-Gerlach experiment, space-quantisation, characteristic and continuous x-rays.

Unit-V : Band theory of solids - conductors, insulators and semiconductors; Bloch Theorem, effective mass, Electric conduction in metals, Sommerfeld theory of electrical conductivity, specific heat of solids - Einstein and Debye theories. Electronic specific heat, Wiedemann Franz law, Hall effect. Magnetic properties of materials: para, dia, ferro, anti-ferro and ferrimagnetism. Curie and Curie – Weiss Laws. Elements of superconductivity, Meissner effect, Josephson junctions and applications; Elementary ideas about high temperature superconductivity.

Unit-VI : Kirchhoff's law, Thevenin, Norton and maximum power-transfer theorems. p-n junction diode, ideal diode equation, use of diode for rectification, zener diode and its use

in voltage regulation. Transistor, its biasing, common emitter amplifier. Digital electronics- Boolean identities, De Morgan's laws, logic gates and truth tables; Simple logic circuits.

Unit-VII :History and development of firearms, their classification and characteristics, various components of small arms, bore and caliber, relation between bore number of shotguns and internal cross sectional diameter of their barrels, choke- purpose, degrees and types, different automatic mechanisms used in small arms- blow back, retarded blow-back, short recoil operated, long- recoil operated and gas operated mechanisms; rifling, methods to produce rifling, trigger and firing mechanisms.

Projectile- velocity determination, determination of velocity of shot-charge, techniques of dismantling/assembling of various types of firearms, identification of origin- various marks on firearms, improvised/Country- made/imitative firearms, and their constructional features, comparative merits of different bores of shotguns, silencers, Headspace and its importance.

Unit-VIII :Types of ammunition, classification and constructional features of different types of cartridges, types of primers and priming compositions. Propellants and their compositions-black, smokeless and semi-smokeless powders, various additives in propellants like stabilizers, chemicals for reducing flash, non- hygroscopic agents, chemicals for conversion of propellants into progressive burning, etc, velocity and pressure characteristics under different conditions. Identification of origin, head stamp markings on cartridges, improvised ammunition, safety aspects for handling of firearms and ammunition.

Unit – IX : Principles and practice of identification of firearms, ammunition and their components how different parts of firearms acquire individual characteristics during their manufacture, types of marks produced during firing process on cartridge cases-firing-pin marks, breech- face marks, chamber marks, extractor and ejector marks, marks on bullets, striation marks of lands and grooves, various factors affecting nature of these marks, measurement of rifling details, i.e., number/ direction of lands and grooves, pitch of rifling etc, imprinted on fired bullets, determination of make/ model of the suspected firearm, techniques of obtaining test materials from various types of weapons and process of their linkage with fired ammunition, photomicrography, non- submission of photomicrographs along with report, presence of matching and non- matching characteristics on evidence and test cartridge cases and bullets, source correspondence, number of matching points, furnishing of opinion- definite positive, definite negative, no definite etc., writing of reports, automatic bullet and cartridge comparison systems, linkage of fired shots with suspected

shot gun, effects of erosion, corrosion etc., effect of human decomposition on bullet striations.

Unit-X : Determination of range of firing, burning scorching, blackening, tattooing, metallic fouling, GSR distribution and dispersion of pellets, factors affecting these phenomena, the stringing of shots, effect of stringing on pattern, cartwheel pattern, balling, determination of range of firing in case of country- made firearms, characteristics of contact shots, distinction between blackening and lead/dirt ring, abrasion, back scatter effect, Walker's test around gun-shot holes in clothes, tests of presence of tattooing around gun- shot holes in skin/ head, IR photography of tattooing around gun-shot holes in dark- coloured clothes, use of various instrumentation techniques for estimation of range of firing, effective, killing and extreme ranges.

Testing of barrel wash, chemical tests for testing for testing of lead/copper around gun-shot holes in clothes, skin and other objects, use of instrumentation techniques in identification of gun-shot holes. Use of instrumentation techniques for analysis of propellant particles found on hands of shooter, fired cartridge case, barrel and target.

DOCUMENT DIVISION

Unit-I:

Frame of reference, inertial and non inertial frames, Rotating frame of reference, Coriolis force Conservation Laws. Collisions, impact parameter, centre of mass frame and analysis of collision in centre of mass frame and lab systems, rotational motion of rigid bodies, moment of inertia, products of inertia, conservation of angular momentum. Central forces, motion under inverse square law forces, Special Theory of Relativity, Michelson-Morely experiment, Lorentz Transformations-addition of velocities, Time dilation and length contraction, variation of mass with velocity, mass-energy equivalence.

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parallel resonance, band-width and Q-factor. Maxwell's equations and their application to plane electromagnetic wave. Poynting vector. Vector and scalar potentials; Wave equations in isotropic dielectrics, reflection and refraction at the boundary of two dielectrics; Fresnel's relations; Total internal reflection; Normal and anomalous dispersion; Lasers, He-Ne and Ruby lasers, spatial and temporal coherence.

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Unit-VI :

Kirchhoff's law, Thevenin, Norton and maximum power-transfer theorems. p-n junction diode, ideal diode equation, use of diode for rectification, zener diode and its use in voltage regulation. Transistor, its biasing, common emitter amplifier. Digital electronics- Boolean identities, De Morgan's laws, logic gates and truth tables; Simple logic circuits.

Unit-VII:

Forensic Document Examination:- Legal aspects of forensic document examination, 293 Crpc, Section 45 evidence act, definition of expert. Indian Penal Code Under sections viz. 420, 468, 471, 120B, 302, 306, 498A, Copy right act, 489A, B, C, D & E, Office Secret act. Classification of documents; Disputed/ Specimen/ Admitted; Care, handling, preservation of documents; Preliminary examination of case documents, Principle of handwriting examination; Importance of natural variations, Holographic documents. Physiology of handwriting, various writing features— terminology and definitions, general characteristics of handwriting, individual characteristics of handwriting.

Nature and types of forgeries, characteristics of genuine and forged signatures, their detection, identification of line quality, artificial and natural tremor.

Unit-VIII :

Classification of Erasures:- Chemical & Physical erasures and techniques involved for their detection and decipherment, Sequence of strokes , working principle & features and applications of Spectral Comparators, principle and working of Electrostatic Detection apparatus and its applications. Ink examination, chemical composition of different types of inks, destructive and non-destructive techniques involved in differentiation of ink. Writing instruments, working of fountain pen, ball pen, gel pen, writing inks, Printing inks and printing toners. Viscosity, Surface tension, Capillary rise.

Unit-IX :

Paper examination:- Physical comparison parameters, chemical composition, sizing & loading materials, tensile strength, comparison techniques: destructive & non-destructive. Serrated edges examination. Physical evidences: Examination of printed labels, wrappers, rubber seal impressions, Facsimile document/ signature examination. Photocopy and scanned documents: process of scanning, identifying features. Charred documents: preservation and examination techniques involved.

Unit-X :

Printed document examination: Printing technology, examination of type-script, classification of printers: identification of printed matter, different printing technologies, Examination of computer printouts, Concept of digital signature. Examination of security documents: Currency notes, Passport, Visa, Various identity cards, Stamp papers, travel documents. OVI ink, thermal ink, Examination of credit, debit and other plastic cards.

By order of the Governor

SATYABRATA SAHU

Additional Chief Secretary to Government